American Machinist

Volume 65 New York, August 12, 1926 Number 7

Getting the Most Out of Your Machine Tool Dollar

By K. H. Condit
Editor, *American Machinist*

Based on interviews with the various executives and engineers who are charged with this responsibility at the Hawthorne Works of the Western Electric Co. in Chicago

NO MANUFACTURER today would think of operating a plant that was not equipped for the greatest possible production. Nor would he, if he realized to the slightest degree the value of maintaining perfect morale and efficiency among his workers, consider for a moment the presence of equipment that did not assure as safe conditions for the operator as it is humanly possible to attain.

This is true no matter what may be the size of the plant; but it becomes particularly obvious in those larger industrial institutions, where the number of employees runs into five figures and where output frequently involves a product made up of thousands of different and distinct piece parts, many of which are turned out by the millions each year.

Efficient and safe production hinges entirely on the proper use of plant equipment. Essentially, it is a question of the most economical utilization of existing facilities and the purchase of new equipment to the best possible advantage. The former phase naturally implies careful calculation to determine that point at which further repairing of current equipment becomes a false economy

Efficient and safe production on such a basis hinges entirely on the proper use of plant equipment. Essentially, it is a question of the most economical utilization of existing facilities and the purchase of new equipment to the best possible advantage. The former phase naturally implies careful calculation to determine that point at which further repairing becomes a false economy.

In a plant of any size such supervision in equipment matters requires a large force of specialists—specialists in all the fields of planning, development and standardization engineering. These specialists are concerned not only with the manufacturing equipment as it exists but also with adapting the plant as a whole to those machinery changes that must accompany any changes or expansion in apparatus being manufactured.

At Hawthorne, which is primarily concerned with keeping the operating telephone companies of the country abreast at all times of the requirements of a communication system that is peerless in scope and efficiency, these equipment specialists, if such they may be termed, include experts in determining when new machinery is needed, development engineers who work out new methods of manufacture that promise either greater economies in cost or a better or more plentiful product, and a third group, known as standardization engineers, whose particular charge is the replacement of obsolete or worn-out machines or other production equipment.

While the work of this third group is probably of no greater value than that of the planning and development engineers, it is more interesting so far as this article is concerned. It includes the development of machine specifications, assistance to and co-operation with machine tool builders, rehabilitation and motor driving of old equipment, development and working out of replacement programs, development of new models of various standard types of production equipment and the safeguarding of every machine in the plant. That

this is a real job may be gathered from consideration of some of the many kinds of machines coming under the supervision of this department. Included are blueprinting, sewing, printing, woodworking, engraving, box-making, diamond lapping and drilling, metal rolling, wiredrawing, cold-heading, laundry, foundry, ceramics, glass-making and rubber machinery, and all of the regular machine tools.

This group also plays a major part in taking a new project and developing it completely for manufacture. The development includes not only the determination of method but the purchase of equipment and the training of operators as well. When the project is turned over to the manufacturing department all difficulties have been overcome and production can proceed without delay.

Machines Pay for Themselves in from One to Five Years

In the purchase of new equipment there is no rigid policy as to the period in which a new machine must pay for itself. The common metal manufacturing machines are expected to return their cost within one or two years at the most. Where the installations are more extensive the period is extended to as much as five years in some cases.

Because of the large extent of the manufacturing operations it is possible to work out standard specifications for the many machines of a given model that are used. When all the difficulties with a machine have been eliminated and it has been decided how much of regular or extra equipment on the machine is needed or can be dispensed with, a standard specification is developed which becomes the record specification on file with the manufacturer who supplies the equipment, as well as in the Standardization Engineering Department at Hawthorne. This specification makes it possible to order additional machines by wire without danger of misunderstandings.

It is the policy to buy only the best equipment available and to pay a price that allows the builder a fair profit. Where orders are placed which are large enough to afford opportunities for manufacturing economies because of the number of units involved, some consideration from the builder is naturally expected. Generally speaking, it is the policy of the company to aid in developing a competitive market for all types of high quality machine tools.

Space Requirements Led to Motor Drive

Space for manufacturing costs money and is, therefore, a prime requisite in production equipment. Consequently, newer, more compact machines replace old ones whether the latter are worn out or not, As might be expected with this policy dominant the conclusion was reached years ago that individual motor drive was the ideal arrangement for the Hawthorne equipment The policy was first discussed as far back as 1911 and actually began to be carried out in 1914.

The advantages of the new type of drive were evident from the beginning, but it soon became apparent that something had to be done to improve the methods of installing the driving motors. There seemed to be only one answer, to put the motor inside the base of the machine wherever this was possible. A serious handicap to this plan was that no one built machine tools that way. Some of the motor people said it would be impossible to cool motors so located and also that their inacessibility would be a serious matter.

To tide over while machine tool and motor people were considering this suggestion, some cone-type milling machines were converted by placing the speed changing transmission in the base and driving the spindle by means of a silent chain. The motor, instead of resting on a projecting shelf at the rear of base and thus adding considerably to the floor space needed, was installed at the side of the base with the shaft parallel to the spindle. The converted cone-type machine while very satisfactory from a production point of view was still a makeshift arrangement and it became necessary to get the machine tool builders to give what was wanted.

In 1916 a sketch of a motor-in-base milling machine was submitted to a manufacturer of milling machines and in 1917 the first machine of this type was delivered. The principle was later applied to lathes, automatic and hand screw machines, and the completion of the motorization of machine equipment is now in sight. It is the belief at Hawthorne that no very large manufacturing plant can afford to use anything but individual motor drive. Aside from the saving of space that can be accomplished there is the flexibility of machine arrangement so vitally necessary when large departments have to be moved or reorganized to take care of changes to product.

An exception to the general rule may be found in some small bench units such as bench drill presses. With such machines it is possible to make up a bench mounting a number of tools as a portable unit, thus achieving the same result in the end. This has been done in several departments. A ball-bearing line shaft is mounted below the bench direct-coupled to a motor mounted in the center. The lubricating system is accessible from the top of the bench. All moving parts are enclosed.

Standard Machines Are Speeded Up

Standard machines are seldom capable of operating at as high a speed as is desired by the Western Electric engineers, although most of them will do better than their builders recommend. Many classes of material other than steel and iron must be cut and consequently the machines can be speeded up. Hand milling machines are operated at a maximum speed of 3,000 r.p.m., hand screw machines have been increased from 2,000 to 3,000 r.p.m. for the $\frac{3}{8}$-in. capacity and from 1,400 to 2,000 for the $\frac{1}{2}$-in. capacity. To accomplish this end, it has sometimes been necessary to build special spindles. There is a limit to spindle speeds, however, which is sometimes set by the excessive maintenance cost if the speeds are set too high.

The maintenance costs on each class of machine are reported monthly. The costs naturally differ with the type of service required of the machine. From these records it is possible to set up an automatic expense budget that varies with the activity of the various respective departments. Any considerable deviation from the budget figures results in an investigation and may lead to machine replacements.

The maintenance work is handled by specialists on each type of machine. All of them are of the regular machine shop force. Occasionally maintenance men will suggest a new way of making adjustments or an improved take-up to a machine not adequately provided

with such features. The improvement is studied by the standardization engineers and if found to be good, the idea is incorporated in all of the machines of the class involved and finally turned over to machine tool builders for incorporation in future models if they see fit.

In connection with the maintenance work there is an extensive stock of repair parts for machines of which there is a sufficient number to warrant it. The parts run all the way from bolts and pins up to complete spindle assemblies. These parts are purchased or made in our plant according to cost. Inventory is kept between minimum and maximum figures by the usual stock-keeping methods. These records show which parts wear out fastest. This information is also passed on to machine tool builders for their guidance.

Safety Is of Prime Importance

Safeguarding of machinery has been given particular attention in all departments. Two factors are involved: first in importance, the safety of the operator and, second, the protection of the machine and tools. As an illustration, all punch presses are equipped with individual motor drives, the flywheel being driven by means of a friction wheel on the inside of the rim. When the press is overloaded the friction will slip and burn out. Soft brass wire shear rings are provided in the connection between the screw and pitman to act as safeties in case of double-heading or other interference with proper press action.

All presses are fitted with adequate oil guards to prevent the splashing of oil on the operator and adjacent surroundings, and with positive front and side gates, which are automatic in their action, or some other safety device such as dial or magazine feeds. These safety devices have been very successful in preventing injuries to operators.

Air is used to eject punchings wherever possible. Stop switches are placed in the most accessible positions and the machine lights are so designed that they cannot be adjusted to improper positions. Wherever possible the punch is so arranged that it does not come out of the stripper. Adjustable stroke crankshafts are provided on blanking presses to facilitate this. Chutes are provided for pieces and slugs wherever needed.

No open-web or spoked flywheels are used and it is not permitted to drill any holes for appliances that might weaken the frame of the press. Press crankshafts have been analyzed and standardized as to the minimum safe diameter figures so that the machine repair department will not reduce the crank or flywheel journal to a diameter less than the predetermined figure. A study is now under way to determine how far it is advisable to go in stiffening up the specification for press crankshaft steel in order to secure better quality and more uniformity.

Improving Punch Presses

Unfortunately, punch presses are still looked upon as presses rather than machine tools and their design could be greatly improved. The problem has been partly solved by buying the best presses on the market and then refining them, as just stated, to meet the requirements at Hawthorne.

This has resulted in very few broken crankshafts, and accidents to operators are uncommon. It may be mentioned that a large portion of the punches and dies are worth several times the cost of the press in which they are used. Some of them are decidedly complicated and must be made by skilled diemakers provided with the most accurate machine tools. For this reason the machine tool equipment of the toolroom is kept in the best possible condition.

When any additional equipment of the toolroom type is required in any portion of the plant, the new equipment is placed in the toolroom, releasing similar equipment for the department in which the original need arose and where the demand for accuracy is not as drastic as it is in the toolmaking department. This plan permits of keeping toolmaking equipment up to a very high degree of accuracy and modernity. Similarly when such organizations as the millwright's or carpenter shops require equipment it is usually transferred to them from some other organization which will be more benefited by the new equipment.

Machinery for which there is no further use is usually disposed of by sale, or, if this is not feasible, by junking it.

The depreciation rates for various types of equipment have been worked out to meet the general classes of equipment and range from 5½ to 12½ per cent per year.

In closing, one more thought on the work of the standardization engineers might be emphasized. Our standards all come from one source. The superintendent of a department or of a branch plant has no authority as far as standards are concerned, except to put into effect those established by the engineer of manufacture. In establishing the standards, his advice is sought.

The standardization engineer is no dictator, far from it. When a new machine is to be installed it is an important part of his job to tell the foreman and the operator beforehand so that when the machine is ready to start they are just as anxious as he is to make it perform up to its guaranty or better. This policy is in line with the constant endeavor to make the Western Electric shop surroundings as attractive, clean and profitable as possible for all concerned.

[The preceding article is the nineteenth under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409, Vol. 62. The second by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521, Vol. 62. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719, Vol. 62. The fourth, by L. C. Morrow, Managing Editor, *American Machinist*, outlining the policies of the International Harvester Co., was published on page 793, Vol. 62. The fifth, by G. T. Christopher, Factory Manager, the Dayton Engineering Laboratories Co., was published on page 907, Vol. 62. The sixth, by D. C. Wright, of the H. W. Caldwell & Son Co. plant of the Link-Belt Co., was published on page 1, Vol. 63. The seventh, by T. C. Vail, superintendent, the Spicer Manufacturing Co., was published on page 175, Vol. 63. The eighth, by E. R. Norris, director of works equipment, the Westinghouse Electric and Manufacturing Co., was published on page 255, Vol. 63. The ninth, by Fred H. Colvin, Editor, *American Machinist*, was published on page 417, Vol. 63. The tenth, by Wm. Bailey, production manager, the Hoover Co., was published on page 917, Vol. 63. The eleventh, by G. S. McKee, assistant factory manager, the Timken Roller Bearing Co., was published on page 995, Vol. 63. The twelfth, by Wm. Hartman, superintendent, the National Cash Register Co., was published on page 1, Vol. 64. The thirteenth, by Percy S. Brown, works manager, the Corona Typewriter Co., Inc., was published on page 183, Vol. 64. The fourteenth, by M. H. Westbrook, shop superintendent, Grand Trunk Railway System, was published on page 261, Vol. 64. The fifteenth, by Jerome R. George, Vice-president, Morgan Construction Co., was published on page 381, Vol. 64. The sixteenth, by W. S. Graham, works manager, Hupp Motor Car Corporation, was published on page 697, Vol. 64. The seventeenth, by James E. Gleason, President and General Manager, Gleason Works, was published on page 809, Vol. 64. The eighteenth, by R. A. DeVlieg, master mechanic, Chrysler Corporation, was published on page 929, Vol. 64. Other articles on the same subject will be published in forthcoming issues.]

Low wages limit the buying power, lessen the market, decrease production and increase the cost of any manufactured article.

Book Reviews

Can We Compete Abroad? By C. C. Martin. One hundred fifty-five pages, 5½x7¾ in., paper binding. Published by the National Foreign Trade Council, India House, New York City. Price 25 cents.

This book is gotten out at a nominal price by the National Foreign Trade Council to give manufacturers interested in exporting their products a popular and easily readable narrative of the foreign trade situation and prospects for American goods. The author is widely experienced in foreign trade, and illustrates his statements with numerous specific examples. He chooses freely from European expressions of opinion on our trade to back up his views of the favorable position of our export business.

The narrative is highly enthusiastic, and the author glosses over difficulties and accepts freely the favorable press stories. While he cites many cases where the Department of Commerce lauds the American exporter, he omits the warnings frequently given to the trade by that Department. As the publishers state, however, the book is not a text on foreign trade, but is intended to arouse interest and incite a desire to look deeper into the subject.

The Engineering Index, 1925. Seven hundred ninety-two pages, 6½x9 in., cloth-board cover, indexed. Published by the American Society of American Engineers, 29 West 39th St., New York, N. Y. Price to members $6, to non-members $7.

The volume includes a brief contents description of approximately 18,000 items of which more than 3,000 are cross-references. It is a guide not only to articles in the field of mechanical engineering but in civil, mining and electrical engineering as well. Its purpose is to give its users access to engineering thought and experience under widely varying conditions.

A list of the periodicals that are indexed is included. Each item gives the title, listed under its corresponding heading, the name of the author, the publication in which it appeared, including the date of the issue and the number of pages, details of the illustrations used, and an outline of the contents. Many 1924 publications received too late for inclusion in that volume are included in the book.

A service rendered in connection with the volume by the Engineering Societies library is the supply of photostatic copies of any of the articles listed. The library also will make translations of any material in its collection.

Foreign Trade in 1926. Official Proceedings of the Thirteenth National Foreign Trade Convention. Four hundred ninety pages, 6x9 in., cloth boards, indexed. Issued by the Secretary of the National Foreign Trade Council, India House, Hanover Square, New York. Price $2.50.

This book contains the complete proceedings and papers read at the convention of the National Foreign Trade Council held at Charleston, S. C., April 28, 29 and 30, 1926. It also contains a list of the names of the 1,014 delegates who attended the convention.

There were 47 addresses at the convention, many of which are of permanent interest. For the first time this annual volume is indexed so that all subjects taken up are readily accessible. The papers of technical and trade interest are in six major groups, covering the subjects of education for foreign trade, export sales policies, foreign credits and banking facilities, communications, advertising, and the "where and how" of export.

Industrial Psychology. Charles S. Myers, Director of the National Institute of Industrial Psychology (Great Britain). One hundred and sixty-four pages, 5x7½ inches. Bound in cloth boards. Published by The People's Institute Publishing Co., 70 Fifth Ave., New York City. Price $2.50.

Five lectures delivered by the author at Columbia University in the summer of 1925 form the basis of this volume. Some new matter has been added. A rather unique treatment of the text is to put the less important paragraphs in brackets so that they can be omitted easily by the skimming reader.

An attempt is apparently being made by the author to prove that the industrial engineer is quite unfitted for factory management and should be superseded by the industrial psychologist. But few readers are likely to agree with Mr. Myers on this point. The engineer has always been ready to admit his shortcomings—too ready, as a matter of fact. But when it comes to giving up his job, and the years of experience and study that lie behind it, to a new group of experts in a science about which so little is known as is the case with psychology, he may be expected to put up a fight.

Another thing about this book that does not appeal is the disparagement of the work of Taylor and Gilbreth. Most engineers know that Taylor was no psychologist but they also know that the principles he set up still hold, although his methods have passed out of use. To the casual reader, Gilbreth's "motion study" sounds more euphonious than Myers' "movement study" with its inevitable biological associations. The author also takes occasion to hammer Gilbreth's belief that there is one best way to accomplish a task. It is likely that the difference is largely one of definition.

Gear Train Design. By William H. Rasche. Published as Bulletin No. 2, June, 1926, by the Engineering Experiment Station of the Virginia Polytechnic Institute, Blacksburg, Va. One hundred eleven pages, 6x9 in., paper binding. This booklet presents a new method of using Brocot's table of decimal equivalents in solving one of the mathematical problems that arise in gear-train design, namely, the finding two whole numbers whose ratio is a close approximation to a given ratio. It also shows how these numbers may be applied to the design of a gear-train. Besides the table itself, which occupies thirty-eight pages, this booklet contains a mathematical explanation in which many interesting properties of the table are demonstrated.

A Bibliography on Research. Forty-six pages, 6x9 in. Published by the National Research Council, Division of Engineering and Industrial Research, 29 West 39th St., New York. This booklet contains selected articles from the technical and trade press covering the years 1923, 1924, and 1925. The references are listed under 51 headings, giving in each case the name of the paper and date of publication, as well as the file number under which the material may be found in the Engineering Societies' Library.

Automotive Production

How Production Methods Vary in Shops Building "Light Sixes"

By Fred. H. Colvin
Editor, *American Machinist*

Clamping and locating devices for cylinder heads of the Cleveland "Light Six" — Special milling heads and rotary tables increase the production rate

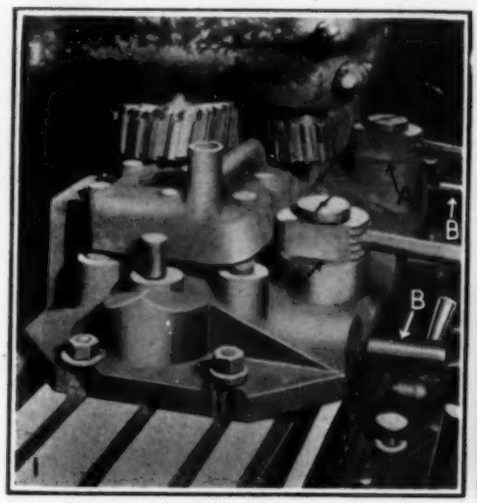
THE cylinder head of the Cleveland engine is of fairly conventional design, with the water outlet cast on top. This design prevents sweeping all the bolt bosses with a single cutter, as in some cases, but the special milling head in Fig. 1 handles them all at one pass of the work. The cylinder head rests on steel pins and the fixture has two eccentric clamps *A* that force the head against jaws on the other side. The front pins are adjustable by means of the knurled handles *B*. The clamps have fairly sharp ridges that hold the head from lifting. The construction of the milling head together with the extra spindle, can be seen in the illustration. The milling time is under 6 minutes.

The second operation is to drill the spark-plug holes. The drilling is done from the under side in the fixture in Fig. 2, which has several unusual features. The head is put in place as shown, one end resting on some of the bolt bosses, as at *A*, after which the arm *B* is swung under the other end so that the plug *C* supports the bolt boss at the extreme right. The arm rests on *D*.

Before fastening the head by the end clamps *E*, the bushing plate is lowered and the head is centered by the jaws *H*, operated by a cam controlled by the crank *J*. The centering jaws act on the sides of the compression chambers of the third and fourth cylinders, and equalize the casting endwise. Then the bushing plate is clamped at each end and the holes are drilled, the drilling time being a trifle over 4½ minutes.

Details of the drilling fixture, Fig. 2, are given in Fig. 5. The drawing shows how the head is centered by the jaws *H*, operated by the cam *J* that works against the hardened end of the adjusting screw shown. The spring below opens the jaws when the cam is released. The swinging support-arm *B* is shown locked in position by means of the plunger *C* operated by the handle beneath. Cams are also used for locking the clamps *D* as can be seen at *E*. The cam also bears against an adjustable surface *K*, so that the desired clamping pres-

The fourth article. The fifth will appear in an early issue.



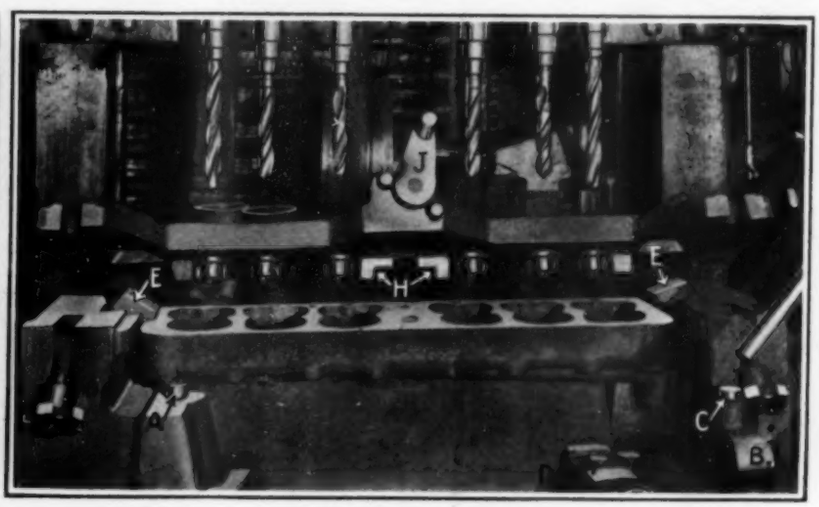
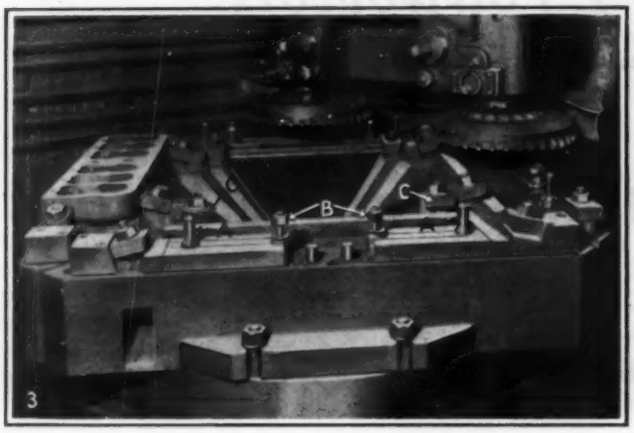


Fig. 1—Surfacing the bolt bosses. Fig. 2—Drilling spark-plug holes

Automotive Production



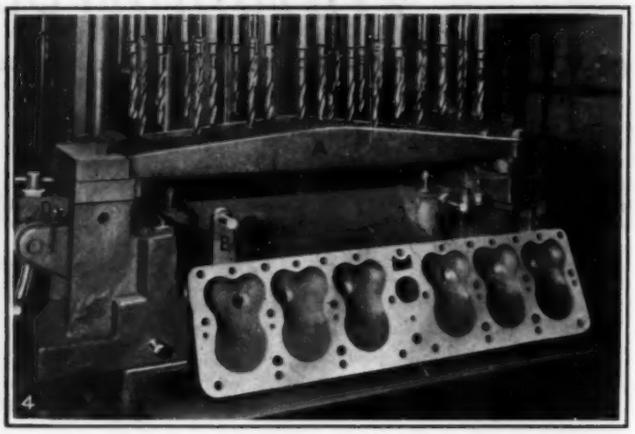


Fig. 3—Milling the joint surface. Fig. 4—Drilling the bolt holes

sure is always available to hold work securely.

Using the end spark-plug holes for locating points, the head is placed over the plugs *A*, Fig. 3, with the bolt bosses as the supporting surfaces. The head is held by the two bolts *B*, through the center spark-plug holes, and by the clamps *C*. The clamps are serrated at the front and beveled at the back, the bevel forcing the teeth into the work as they are screwed down. The table carries the work under the cutters, the first cutter roughing and the second one finishing the joint surfaces. The drilling time per cylinder head is 5 minutes.

The bolt holes and water holes are then drilled in the fixture in Fig. 4. The head is located by dowels in the end plug-holes as before. The dowels, controlled by the cranks *B* and *C*, are made to disappear to allow the head to be slid in under the bushing plate *A*. The clamps at the ends are operated by cams, one being shown at *D*. A head that has been drilled and had the spark plug holes countersunk, ready for tapping, is shown in front of the fixture. A little study of the drills will show that those for the water holes set much higher than the others, so as to reach through into the water jacket only. The drilling time is 6.35 minutes.

The fixtures shown in this article can well be studied to advantage, since they embody a number of features that are not found in all shops. Among these features are the toothed clamps in Fig. 1, and the supports in Fig. 2, that swing under the work to hold it and are out of the way for loading. The exhaust pipes behind the milling cutters in Fig. 3 are also out of the ordinary. They take the dust away from the work and the operator. The locating and locking devices in Fig. 4 are also somewhat uncommon. All are worth careful consideration.

Although we occasionally hear of other industries that have used what we term "line production" for many years, it was not generally known until introduced into the Ford plant about 14 or 15 years ago. The conditions existing in automobile production shops made its early adoption possible in many plants of the industry and it is now general practice.

The great advantage of the method is in the time saved between operations, as this can easily exceed the actual machining time at present. The line method also saves much in the amount of material in process and insures a continuous flow of parts to assembly.

If one stops to consider the amount of shop transport necessary to carry parts for even 1,000 cars a day to a different department for each lathe, milling, drilling or grinding operation, the time lost would be appalling. In its place we have the machines lined up according to the sequence of operations.

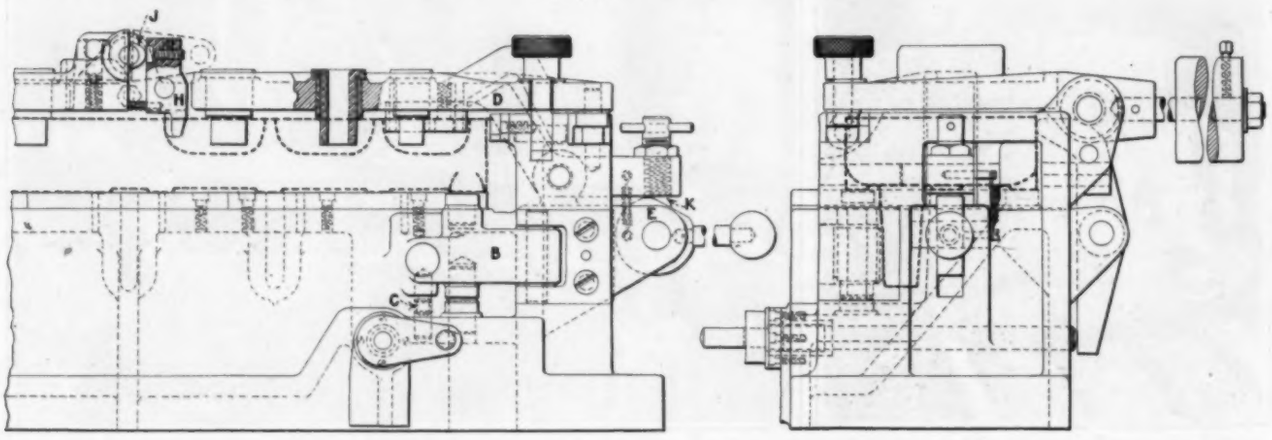
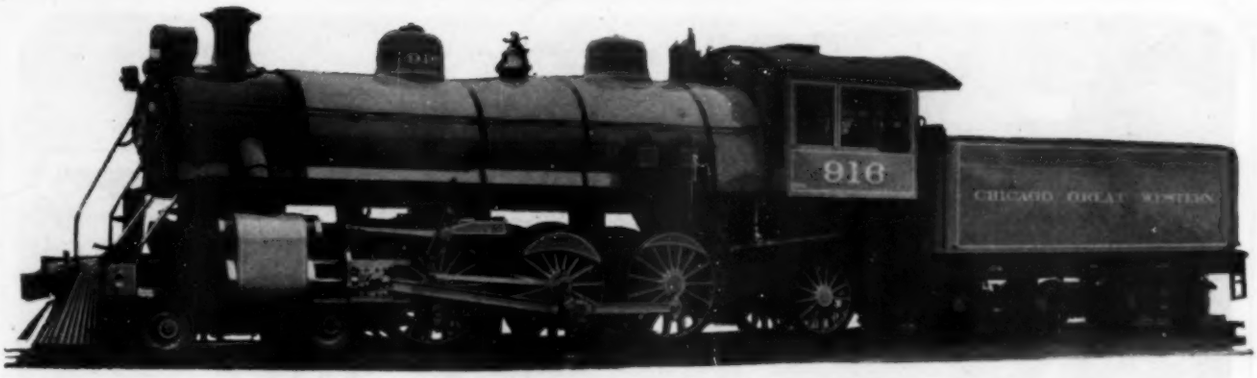


Fig. 5—Details of drilling fixture



Time Savers in the Great Western Shops

By Frank W. Curtis
Western Editor, *American Machinist*

WITH repair costs as high as they are today, time-saving operations, applicable to the maintenance of machinery and mechanical units, are considered a necessity in shops that are anxious to have the repair-dollar go its furthest. This condition is evidenced in railroad shops by recently-improved methods that have been applied to locomotive-repair work. Some shops are limited in this direction, while others devise equipment that is suited advantageously to their needs, yet in most shops the tendency is to obtain tools that allow repairs to be made at a minimum cost.

The Chicago Great Western R.R. shops at Oelwein, Ia., have many novel devices that effect worth-while savings in repair time. An essential requirement in these shops is to avoid, as far as possible, heavy machine-cuts. Rather than to cause a tool to burden itself by removing an excessive amount of metal, castings and forgings are made so that the minimum

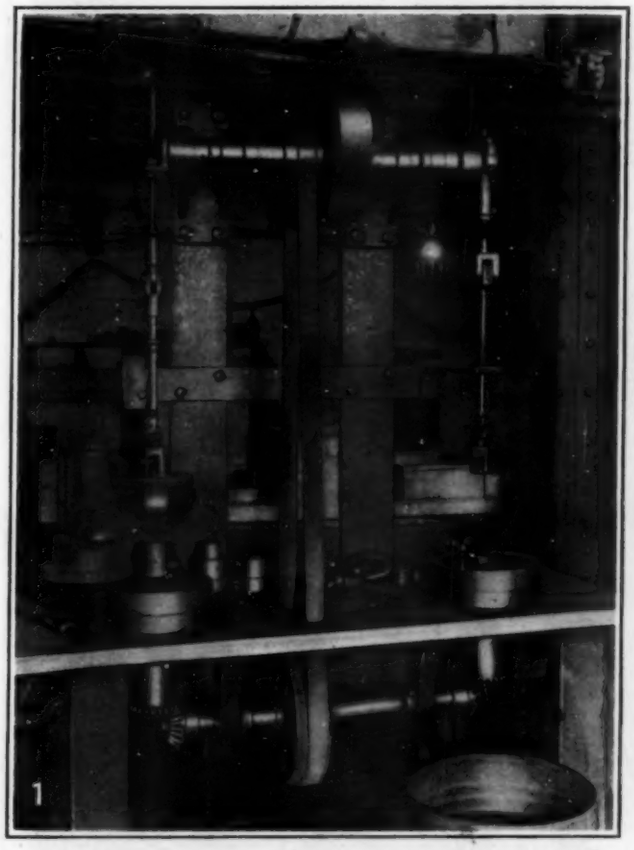


Fig. 1—Lapping machine for air units

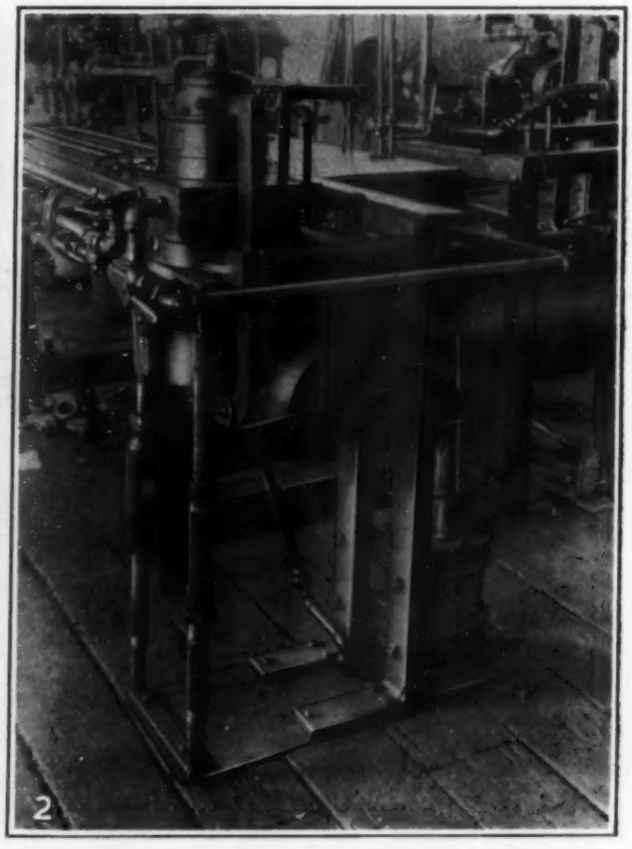


Fig. 2—Stand for testing brake valves

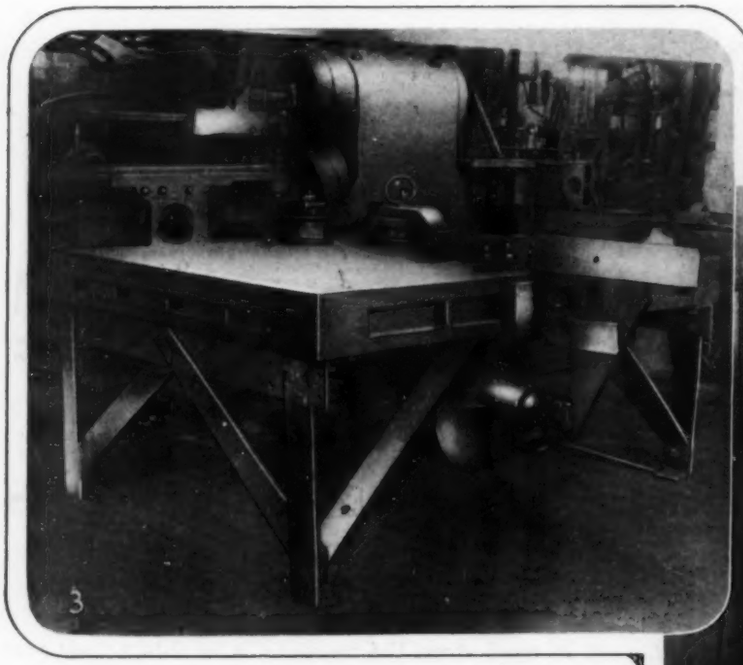


Fig. 3—Air-operated pipe vise

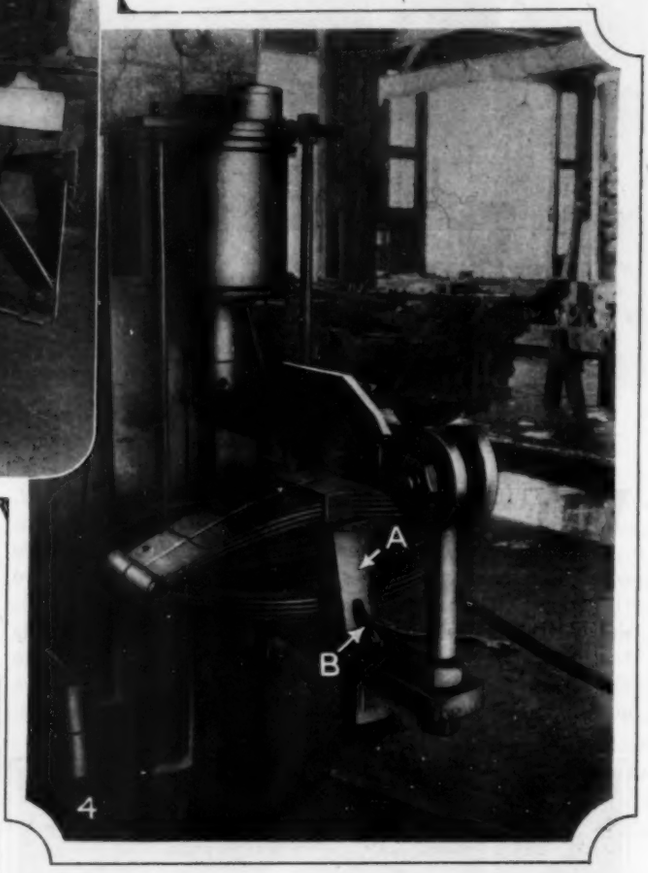


Fig. 4—Unit for compressing springs

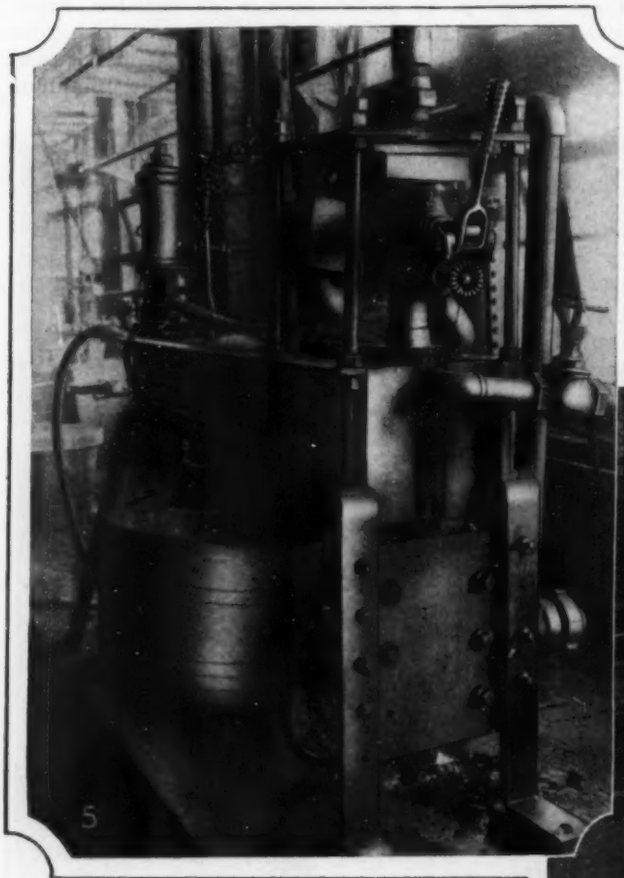


Fig. 5—Test stand for injectors

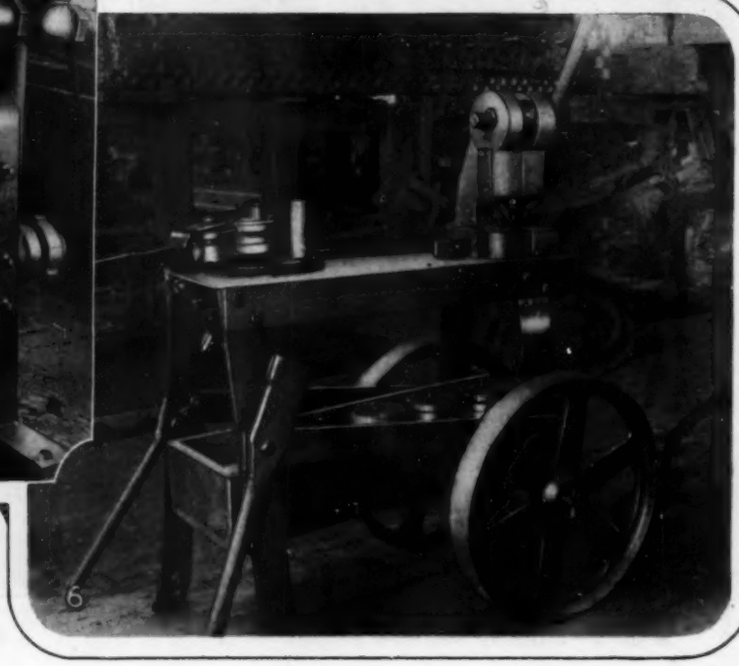


Fig. 6—Portable pipe-bending rig

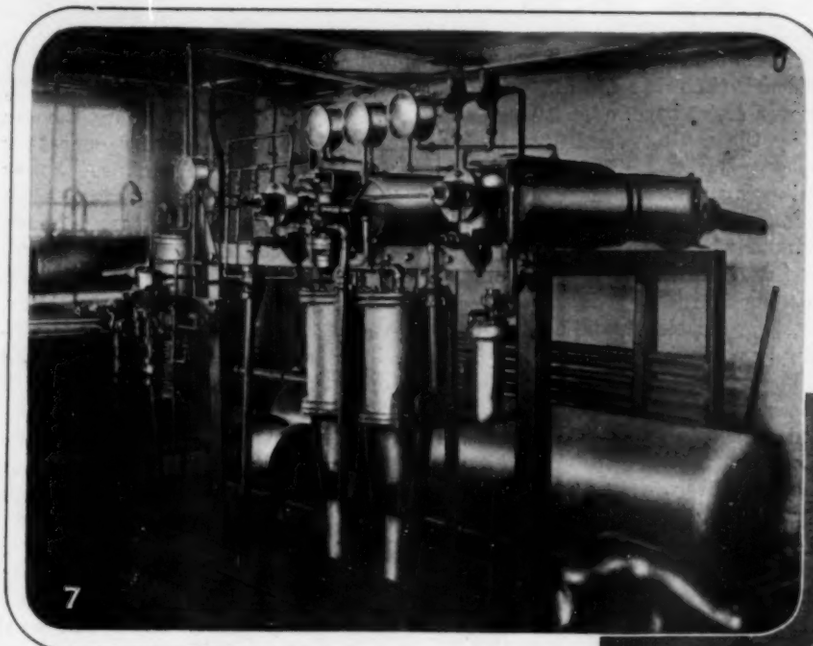


Fig. 7—Complete air unit for instruction purposes

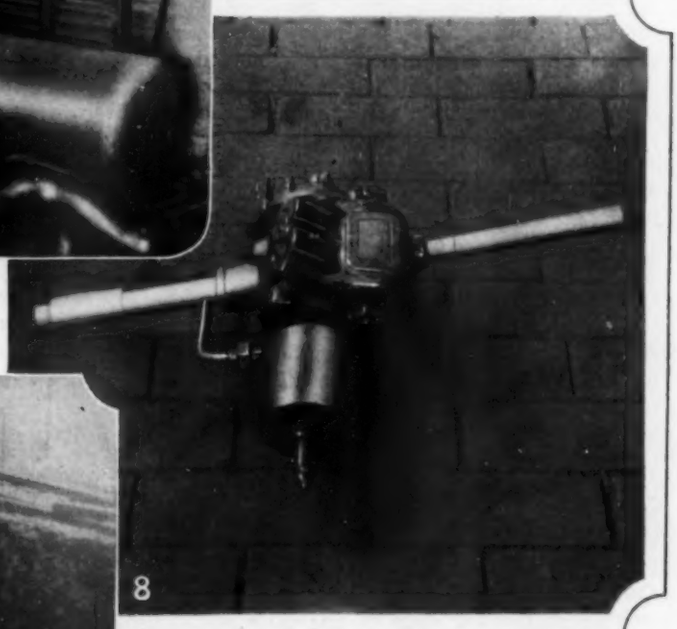


Fig. 8—Air feed for air motors

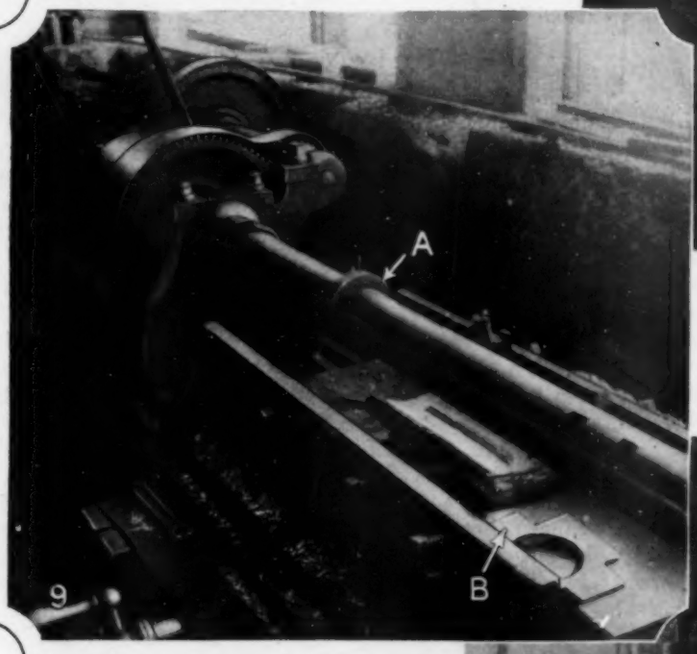


Fig. 9—Boring engine-truck brass

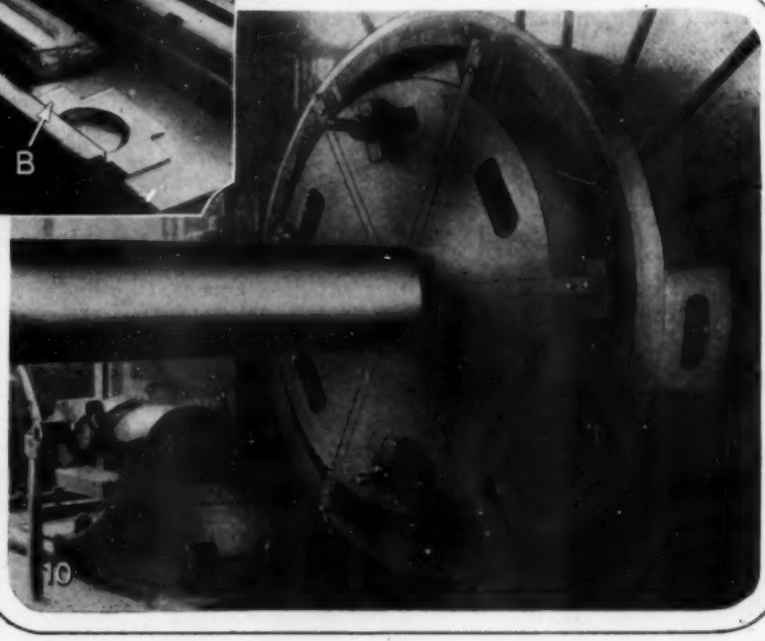


Fig. 10—Chuck for turning tires

amount is left on surfaces that require machining. Adherence to this practice has been found to prolong the life of machine tools and to reduce the amount of wasted material. In some cases, additional time is required by the forge shop to maintain closer sizes, but this slight increase is more than offset by the saving of time in the machine shop.

When the wearing in of rings in distributing valves was done by hand, the necessary work consumed considerable time. Now, this work is handled by the device shown in Fig. 1 which simplifies the operation and makes possible the completion of wearing in in 15 min. The valves are clamped on the revolving locating tables so that they line up with the plungers having the piston and ring assembly mounted on them. The overhead countershaft is provided on both ends with cranks to which the plungers are connected. A belt from the countershaft to the lower shaft drives the tables through bevel gearing. In operation, the plungers are moved up and down while the work is revolved. Oil is applied to the surfaces being worn in to render a smooth finish. Triple valves and brake valves also are handled in the machine.

Brake valves are tested on a stand against which the work is clamped by two hook-bolts that are connected through an arm to a 6-in. air cylinder. Fig. 2 shows the stand with a valve in position. Air connections resembling those used in the actual application are provided. After a unit has been tested, the pressure in the air cylinder is released by a lever on the left-hand side. The operator then spreads the hook-clamp a distance sufficient to permit the removal of the work.

Heavy pipe bending is handled in the machine illustrated in Fig. 3. A 16-in. air cylinder, mounted under the table, is connected through an arm to a sliding ram positioned centrally on the top of the table. Two rolls that can be adjusted to different center distances are located on the far edge of the table. The pipe to be formed is placed against these rolls, after which the ram is actuated so it strikes the pipe midway between them. Adjustments are provided by which the ram can be positioned for longer or shorter bends. Pipe up to 2 in. in size is handled in the machine, necessitating rolls corresponding with the pipe size to be placed in the ram and stationary supports.

Time-Saving Rig

Smaller pipe is bent in the portable rig shown in Fig. 6. The pipe is located between a rear stationary roll and a vertical pin, then formed by the hand-operated roll that is swung in an arc around the rear roll. Rolls to accommodate different-sized pipe are included in the equipment. To the right is mounted a hand punch, used in connection with the making of pipe straps, brackets and supports. Different-sized punches and dies are used with the unit. The rig is a time saver in that it can be transported easily to the job and made to handle a majority of the smaller pipe work.

An air-operated device is used to compress car springs prior to their being assembled in place, and in Fig. 4 is shown a five-leaf, double-type spring in the rig about to be compressed. When the plunger in the 12-in. air cylinder is brought down, the crossbar connected to it and fulcrumed at the opposite end, compresses the spring so it can be confined by the plate *A*. The compressed position is maintained by inserting pin *B* through the opening in the projecting end of the plate. The unit is fastened to a pillar between pits so it is accessible to several car gangs.

A stand for testing injectors is illustrated in Fig. 5. Two 8-in. air cylinders are used for clamping the work, a lower cylinder operating vertically to clamp the air and steam connections, and a rear cylinder operating horizontally to seat the delivery-pipe end. A boiler check is used to hold the pressure at the same point as when the injector is in service. The test is made rapidly by the unit. Another testing device is the complete air unit, shown in Fig. 7 and located in the air department. It is used for making comparative tests, and to instruct apprentices on the operation of air control. Dangers of air leaks and defective connections and their effect in train operation, are explained easily with this unit.

For the drilling of holes between frame members and in other close-quartered locations, air motors, similar to the one shown in Fig. 8, are used. An air cylinder, made of steel tubing, is mounted on the motor in place of the usual screw feed, the piston carrying the usual center at its outer end. The cylinder is connected to the air-inlet pipe by a ¼-in. connection. A coil spring within the cylinder holds the piston in an inward position when the unit is not in use. When the motor is operated, the air pressure forces out the piston, providing a feed movement of 3½ in. Ninety pounds air pressure is used, causing a more uniform feed than is usual by the hand screw.

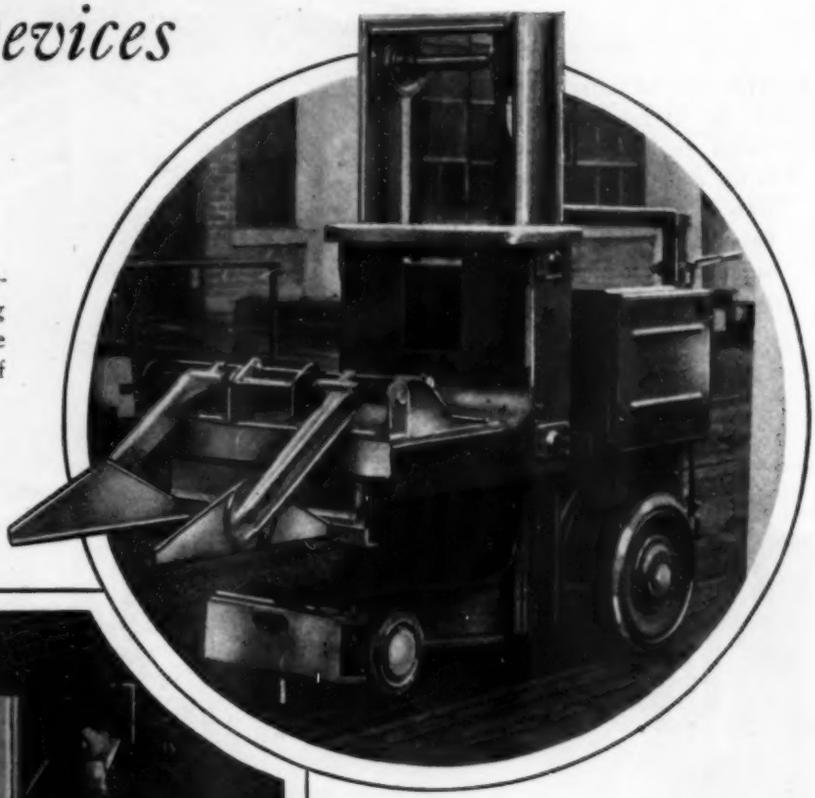
Use for Rebuilt Machine

Engine-truck and trailer-truck brasses are bored to size as shown in Fig. 9. A rebuilt lathe, fitted with a work-holding fixture on the carriage, is used. The boring bar carries tools to suit the size of box being bored. The gage *A* is used to position the work centrally with the bar. The gage *B* is used to set the boring tool in relation to the radius desired. It is rested on the bar next to the cutting tool and, by means of the three gage faces, the tool can be adjusted to suit the type and size of box. The usual roughing cut is taken, then the feed of the carriage is reversed for the finish cut. The spring of the tool during the roughing cut governs the amount of material that is removed in the finishing cut. A templet is used to check the finished work.

Tires are turned in a wheel lathe equipped with chucks that grip the work at six equally-spaced points, as shown in Fig. 10. The jaws are adjusted by trams in relation to center-punch marks located on the jaw slides. Each jaw has an L-shaped contacting surface that fits the bore and the flanged face of the tire, insuring alignment. Individual adjustment of the jaws is provided by a screw and nut fitted in the chuck body in line with each jaw.

The headpiece shows the engine used on the "Red Bird" special that operates between St. Paul and Rochester, Minn. It is a Pacific-type locomotive slightly changed in outside appearance to resemble that of an English-type engine. All pipe fittings are concealed to offer a straight-line effect. The engine is painted maroon with gold trimmings, and has highly polished motion work. It was recently overhauled, after operating more than 140,000 miles. The condition of the operating parts showed only slight wear, indicating that accurately-fitted units, carefully machined, will give the ultimate result—more miles between shoppings.

Using Lift Trucks With Special Conveying Devices

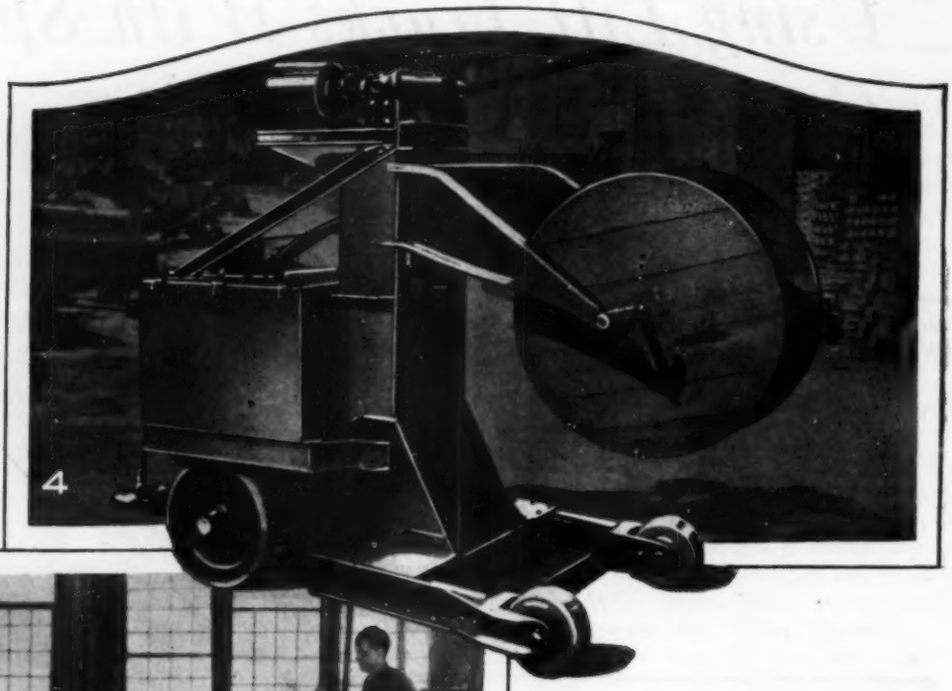


1—The special forks on the lifting device of this truck are for handling piles of metal cast into pigs. The forks can be adjusted for pigs of different lengths.

2—Pigs of some non-ferrous metals have projections at their ends. A pile of such pigs, properly stacked, can be picked up and transported by a truck equipped with the forks shown in the previous picture.

(*Continued on next page*)

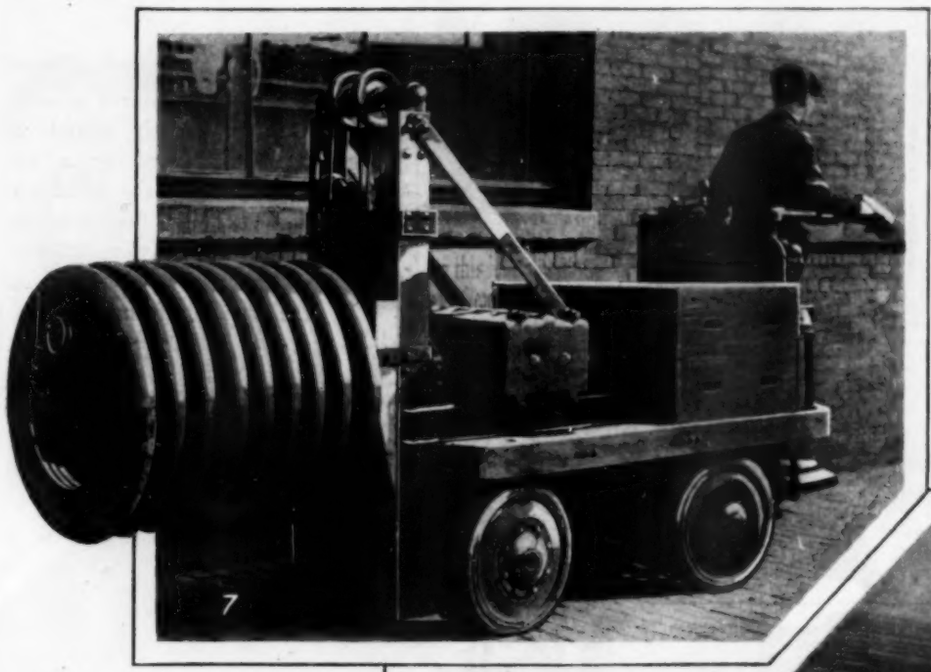
3—Here the stack of pigs has been lifted by running the forks under the projections of the bottom layer and raising the lifting attachment. The stack can now be transported to any designated point.



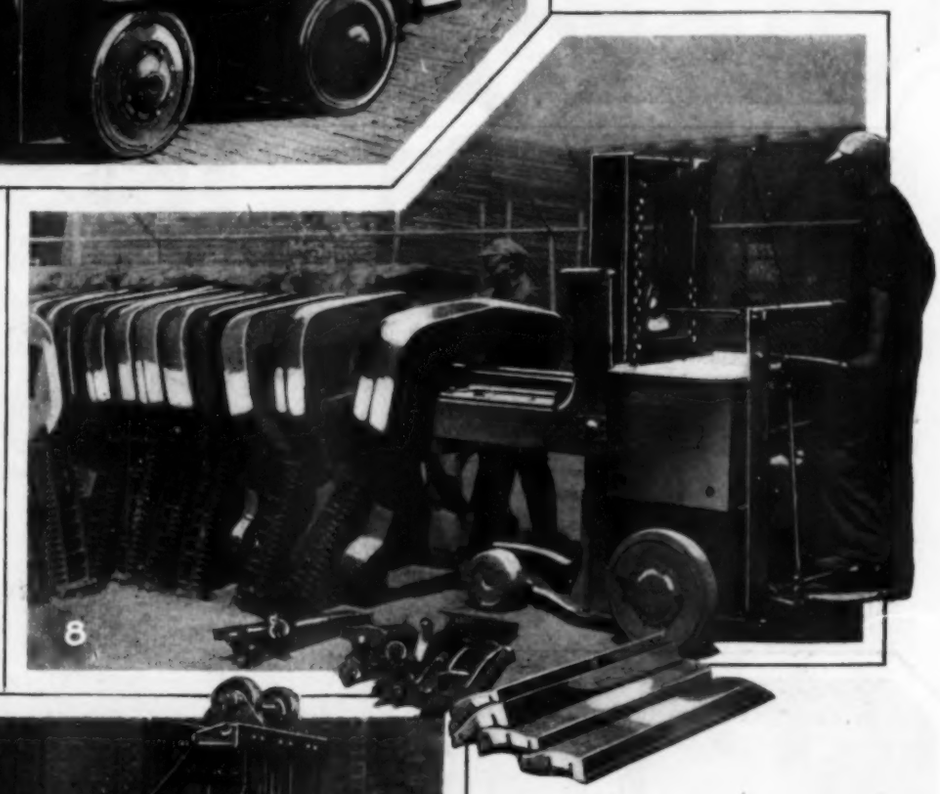
4—The type of attachment to the lifting device as shown, enables this truck to lift and transport large reels of cable. The arms have half bearings at the outer ends to receive a bar run through the reel.

5—Steel cans, or barrels, are awkward to handle when filled with metal parts. A fork on the lifting device of the truck will straddle the can, supporting it by the reinforcing band.

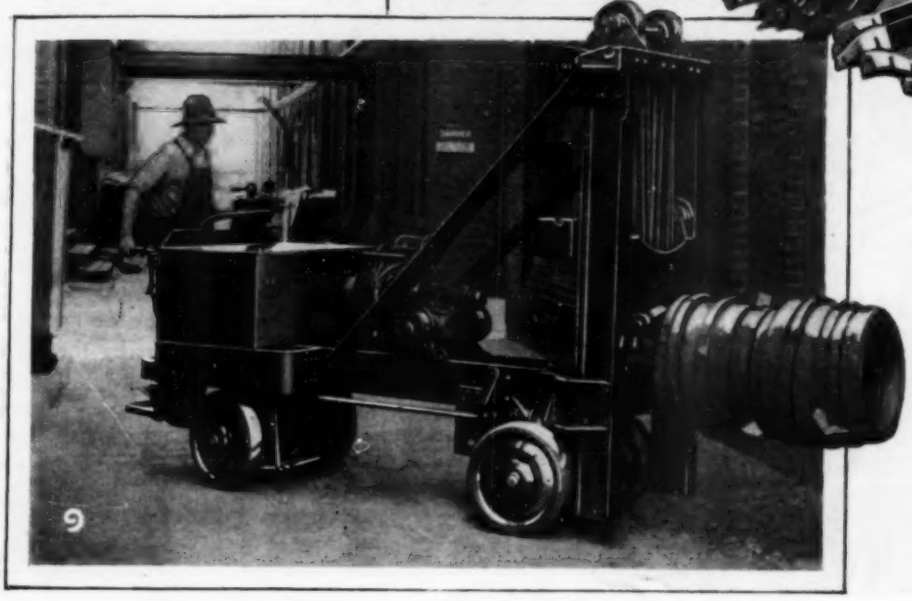
6—A stack of pig metal can be handled by a chain sling. If the truck is equipped with a crane, there will be no need for a special attachment for lifting such a load.



7—Tire molds make an ideal load for a lift truck. This truck has a heavy horn attached to the lifting device. The horn is run through a number of molds, as shown in the picture.

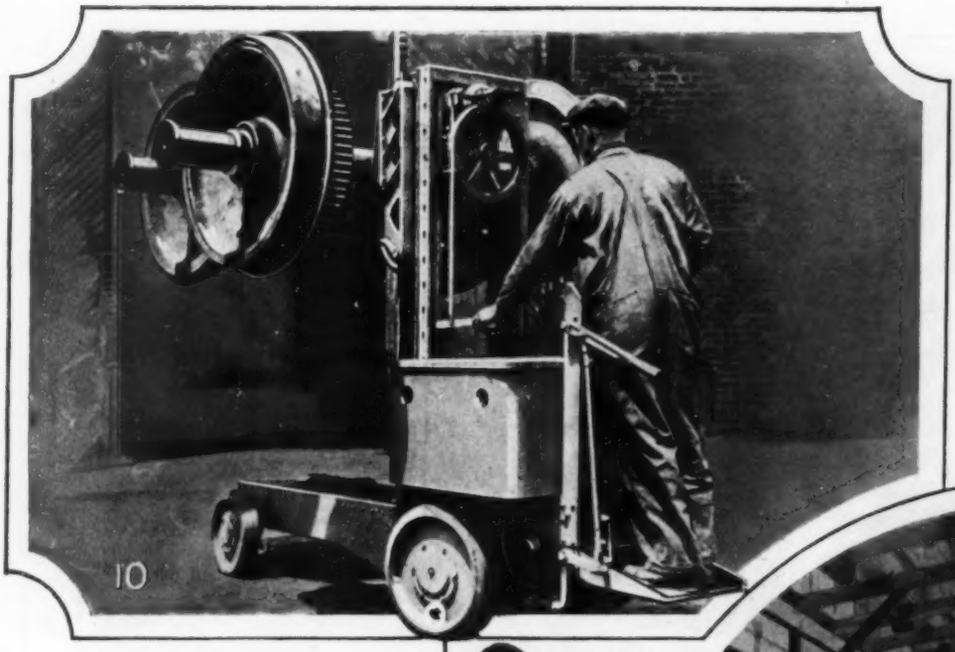


8—Sections of cast-iron boilers offer a splendid opportunity for the use of a lift truck. Like the tire molds, they can readily be handled by a projection extending from the lifting device.



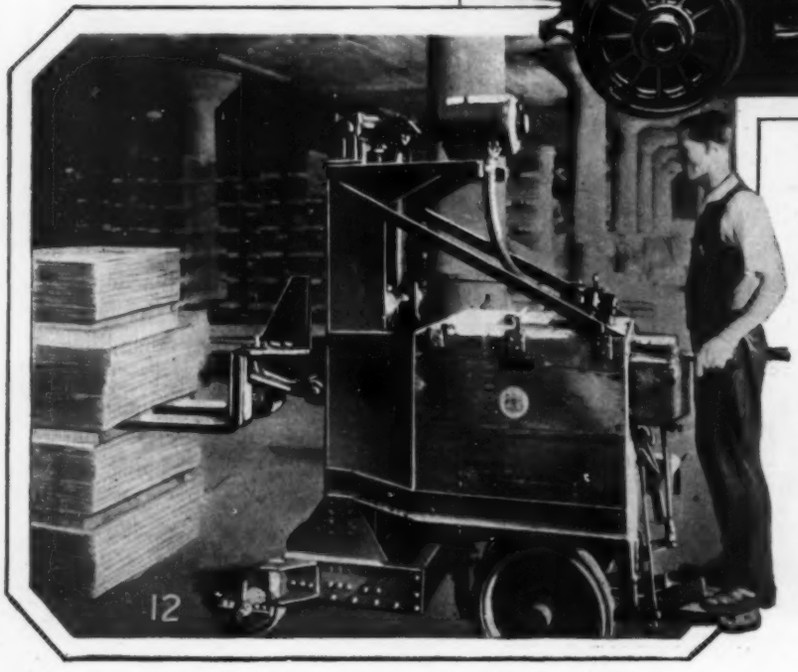
9—The horn attachment is equally serviceable in mills and warehouses handling coils of strip metal. Here again a truck so equipped is carrying such material from the mill to the shipping department.

(Continued on next page)

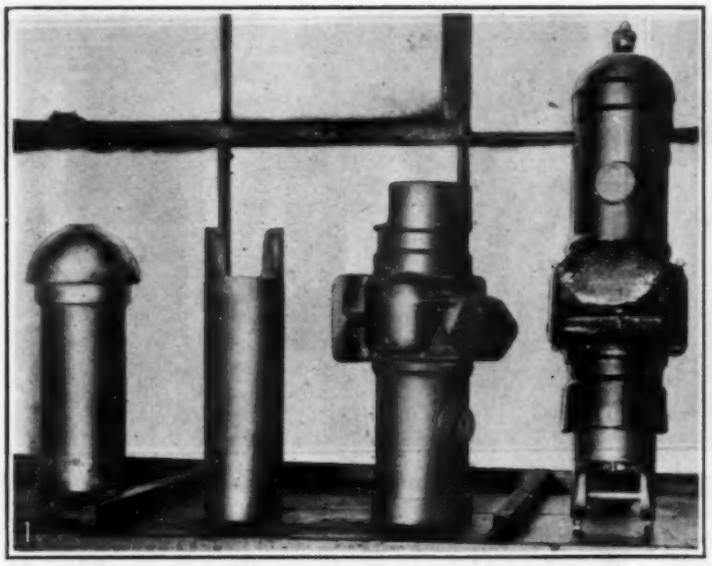


10—Car wheels mounted on axles are conveniently picked up and transported by a lift truck. Since the axles are well above the floor line, the lifting device can be used without the work placed on the usual platform.

11—This truck is used in a refrigerator factory. It is equipped with a special lifting arm that goes under the refrigerator body, entering the opening provided for the drip pan.



12—The lifting arm of this truck enters the space between parts of a stack of paper. Separating the stack into layers by the introduction of spacing strips, obviates the necessity for a platform.



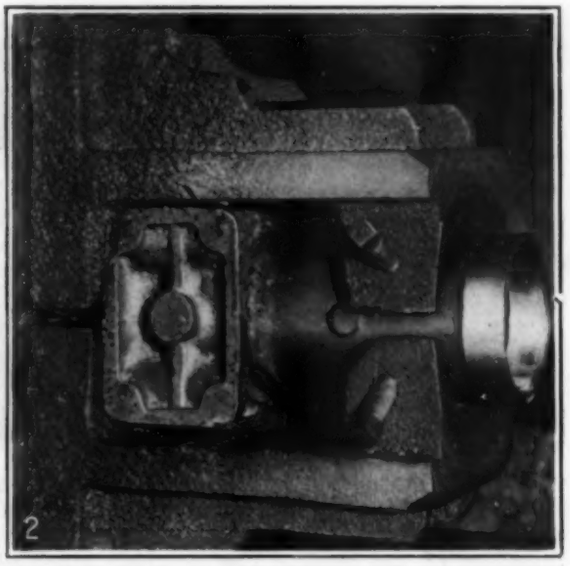


Fig. 1—Parts of Gruss air spring. Fig. 2—Chuck for boring body

Tools for Making Air Springs

By Frank C. Hudson

Fixtures and methods that utilize standard machines as well as special devices for closing tube ends at a single heat

THE manufacture of devices to improve the riding quality of motor vehicles has grown to be an industry of large proportions, and involves the use of methods and machinery that may be applicable to other lines. The making of the Gruss air spring by the Cleveland Pneumatic Tool Co., Cleveland, Ohio, includes a number of interesting methods, some of which are outlined herewith. The component parts of the Gruss air spring are shown in Fig. 1 beginning with the air chamber at the left, the crosshead cylinder next, with the body and the completed spring following. The air chamber is made of seamless steel tubing and the crosshead is a steel forging.

Beginning with the body, the lower end is bored and the upper end turned and threaded in a Gisholt machine. The upper-end job is shown in Fig. 2. Special

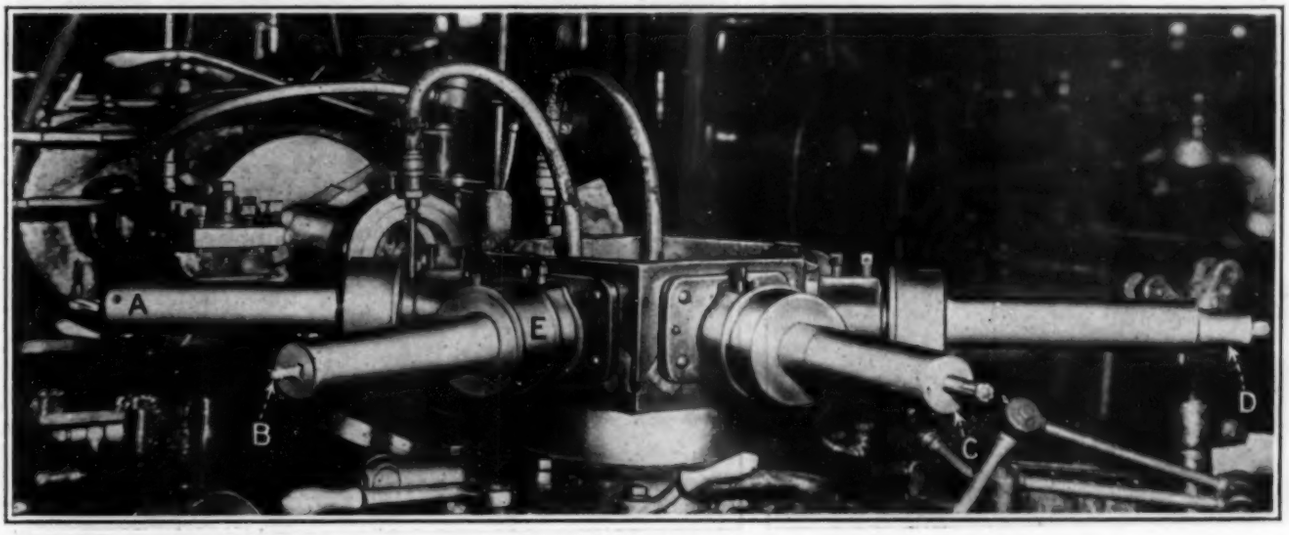


Fig. 3—Tooling for boring sleeve

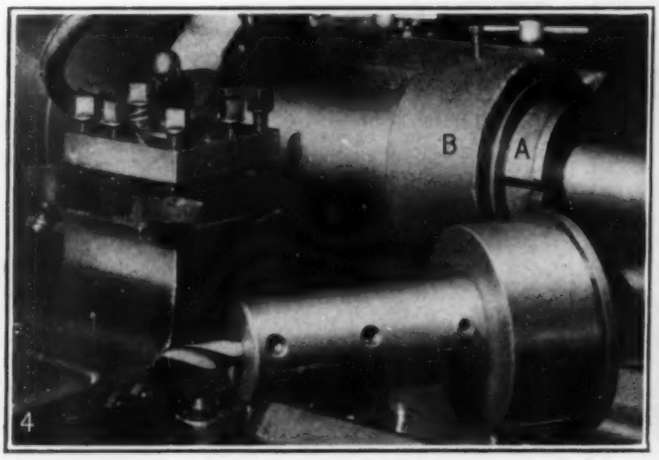


Fig. 4—Details of boring-bar guide.

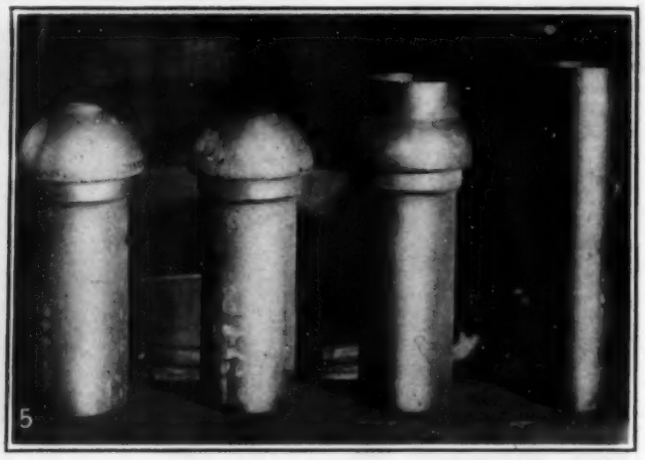


Fig. 5—The air chamber in process

steel jaws hold the body for boring, turning, and threading on the inside. The setscrews allow adjustment of the end of the body to suit the casting. The alignment between the bores at each end must be good to allow the crosshead to slide freely over the lower end of the air-chamber cylinder.

In the boring of the lower end of the body for the sleeve, about 0.008 in. was originally left for grinding. By reaming, however, the grinding allowance has been reduced to 0.004 in. and so reducing the grinding time. The grinding is done on one of the new, Heald internal grinding machines.

The crosshead carrying the lugs for attaching to the springs is forced into the sliding sleeve with an air hammer, before being brazed, instead of being forced in by a press, this method having been found to be easier and quicker. The boring of the sleeve is shown in Fig. 3, a large Warner & Swasey turret lathe being used. This view shows the general tooling arrangement, including the combined drill and boring bar at *A*, the single-point boring tool at *B*, the tap at *C* and the reamer at *D*. On each bar will be seen a guiding bushing as at *E*. These bushings enter a stationary guide-bushing in the outer end of the steadyrest, and support the bar as near the point of cutting as possible. At the same time, the outside of the sleeve is turned by the tools in the cross-slide toolpost. Fig. 4 shows the guide bushing *A* in the steadyrest *B*, with the keyway at the side to prevent turning.

The steps in the process of making the air chamber are shown in Fig. 5. The tube is shown at the right, and the result of the first operation is next, to the left. The closing in of the end is done in a heavy milling machine that has been converted for the purpose, Fig. 6. The end of the tube is heated in a conveniently placed furnace, and the tube placed in the chuck *A*, which is revolved on two rollers, the pressure of the closing-in roll *B* being downward.

The first operation rolls the tube as shown at *C*. Without further heating, it is again put in the chuck and the end closed as shown in Fig. 5. The final closing of the end is done with the tool shown in Fig. 7. After the tube forming the air chamber has been finally closed, it is tested for air-tightness in a device built especially for the purpose. This device is in the form of a press with a ram on top that carries a pressure gage.

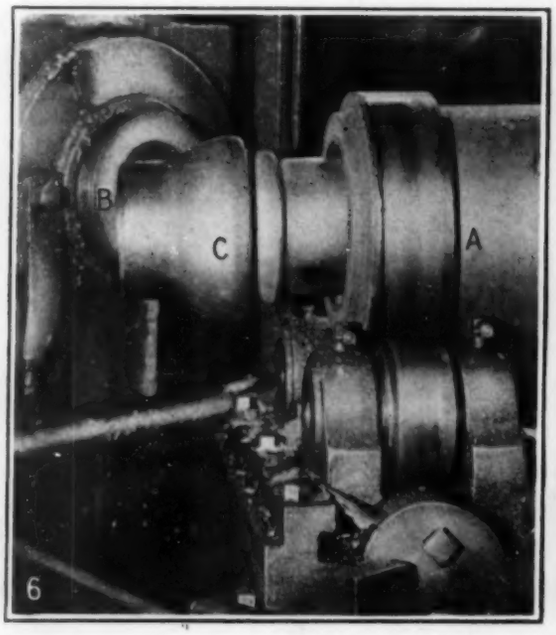


Fig. 6—First rolling operation.

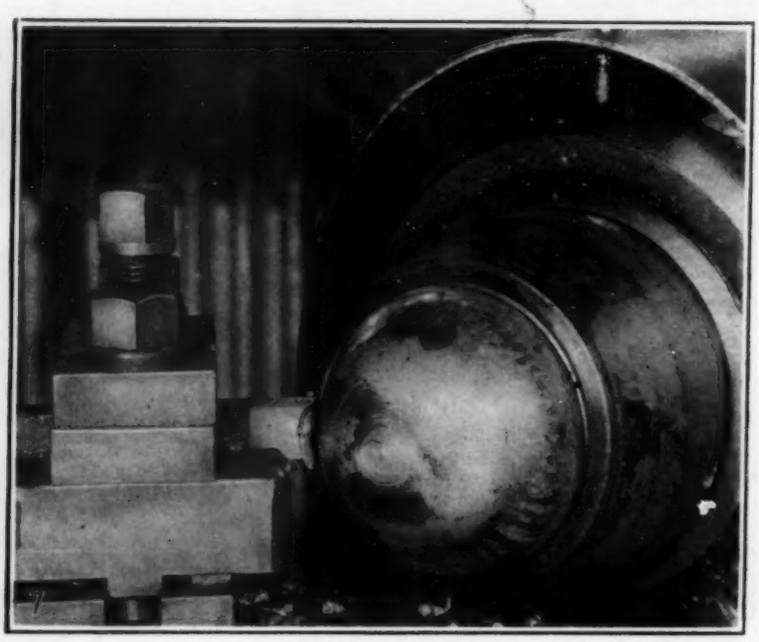


Fig. 7—Closing the end

Giving Foremen in the Small Shop an Important Rôle

By Frank Waldo

Outline of a simple co-operative system that gives the foreman an incentive to create labor-saving ideas, rewarding him by giving him a share of the profits

HAVING a good product to manufacture and good machinery to produce it, does not mean instant results. The human element must be considered. Proper supervision and satisfied workmen are essential to get the most out of the machine-tool dollar. For this reason, careful consideration should be given to the workers' interests if success is to be achieved.

Working on this basis as a foundation for production increases, the Indianapolis Pump & Tube Co., at its Greenwood, Ind., plant, has been successful through its co-operative plan in building a productive organization. The company manufactures automobile tire pumps and steel tubes, and employs approximately 125 men. Experience has shown that keeping the men in the shop satisfied so they will exercise their mechanical ability in devising short-cut methods, will net more profit per man than by trying to drive work through.

If the men are given a percentage of the savings they can effect, it is natural to assume they will save all they can. One requirement of the plant is to eliminate, as far as possible, all "ifs" and "ands." A lot of strings connected with a profit-sharing system will give results as bad as the lack of co-operation. If a foreman is put on the job and told—"There is the work—it pays so much—the method is the best we know of—you can share in the profits of any savings you can accomplish," the result is, in most cases, that he will keep his mind constantly at work trying to develop improvements.

The object of the system is to control production and overhead, and to give the workmen a share in the profits. The manufacturing cost of each product is based on the total time required to perform all operations from raw material to finished product. Time studies are used to obtain these costs. With these figures, and the amount of production required, a week's schedule is made out by the superintendent and subdivided to the foremen in relation to their part of the work. An overhead of 75 per cent is allowed, this amount being calculated from an average operating period.

Piece rates are based for a three months' duration. The base price of an operation is made from a 100-per cent time study in which a 25-per cent time allowance is granted. For example, if an operation is timed at 3.8 sec. per piece, the 100-per cent production would be 947 pieces per hr. Allowing 25 per cent of this figure will give 710 pieces per hr. The base hourly rate of the operation is then made out on this rate, which, under ideal conditions, allows the operator a profit of 25 per cent.

The foreman in charge of a group of men is held responsible for all the work done in his department. If he can apply a better producing system, or any tools that can reduce costs, the savings are credited to him. His reward is 25 per cent of the gross savings earned during a period of one week. This bonus is allowed for a total duration of one year from the time the saving is put in effect. If the saving has increased the production on a machine, the operation cost is unchanged until the three months' time-study limit has

INDIANAPOLIS PUMP & TUBE CO.
PAY TICKET

PART NAME	TRAVELER NO.	OPERATOR	DATE
#11 Caps	600	#14	5/1
OPERATION NAME	**OPERATORS NAME**		**NO. PIECES**
Cut Off	G. Short		
DEFECTIVE PIECES	**RATE PER HOUR**	**RATE PER HUNDRED**	
		2¼	

TIME IN
MAY 1 2 .8

TOTAL TIME

TOTAL RATE

TIME OUT
MAY 3 3 .1

Fig. 1—Pay ticket made out for job

expired, in which case the operator also benefits by the improvement. When a new piece rate is made, it is figured as previously mentioned.

After a foreman has developed several savings, his bonus is attractive. Rather than have it reduced, since time limits expire on the yearly allowance, he is anxious to create further savings that will keep the bonus uniform. In one sense of the word, he is in business for himself, and takes an unusual interest in his work, since he benefits on whatever saving is made. He is anxious to have the operators produce a 100-per cent quota, since his bonus is also increased in proportion to the total production.

In the event that the weekly production falls short of the estimated schedule, through fault of the foreman or operators, the foreman loses 75 per cent of his bonus for that current week. The allowance of 25 per cent is granted to keep him satisfied. Knowing the result of the failure to produce a given amount of work, the foreman co-operates with his men to eliminate any production losses. Failure to keep the schedule rarely occurs. The majority of foremen have been selected from the shop within the past two years.

The remaining 75 per cent of the savings, called fac-

tory gain, is divided equally between the superintendent, who is in complete charge of all the work, and the company. All savings are investigated by a time-study man, reporting directly to the superintendent, who in turn passes on all improvements.

Even the time keeping and production supervision are operated on a profit-sharing basis. At first, it would appear to be a problem to keep a record of the system, but simplicity in methods enables the work to be handled by two men devoting their entire time, and one man who is required only part time. A cost allowance is granted to the head timekeeper and the production supervisor, and any savings they can make are entirely to their credit.

LOT I Nº 600

TRAVELER

PART NAME		DATE
NO. PCS.	INSP. PCS.	
Operator Name		No.
Operation	SLIT and FORM	No. Pcs.
Operator Name		No.
Operation	WELD	No. Pcs.
Operator Name		No.
Operation	SWEDGE	No. Pcs.
Operator Name		No.
Operation	SWEDGE	No. Pcs.
Operator Name		No.
Operation	WIPE	No. Pcs.
Operator Name		No.
Operation	CUT OFF	No. Pcs.
Operator Name		No.
Operation	THREAD	No. Pcs.
Operator Name		No.
Operation	INSPECT	No. Pcs.
Operator Name		No.
Operation		No. Pcs.
Inspector O. K.		Cost

Fig. 2—"Traveler" used to record finished work

When an operator starts a job, he obtains a "pay ticket" such as shown in Fig. 1. The time of starting is stamped at the left-hand side by the time clerk, after which the ticket is placed in a master board that has a pigeon-hole provision for each operation in the shop. Upon completing the work, the operator calls for the ticket which, in turn, is stamped at the right-hand side to signify the time of completion. At the same time, the operator obtains another ticket to correspond with the new job he is to do. In this way, there is no gap or lost time between jobs. Pay checks are made from the ticket by adding the operator's total rates, shown in the lower-center portion, for a period of one week.

To check a finished order of work going through the shop, the record of the pay ticket is transferred to a "traveler," such as shown in Fig. 2. As the tickets are stamped out, the time clerk fills in the corresponding operation on the "traveler." Active "travelers" are kept by the clerk, until they are completely filled out including the inspection operation. Then they are turned over to the timekeeper who records the finished work on a report that is sent to the main office. Incidentally, the "traveler," at a glance, shows the amount of any scrap work that is produced, because there will be a discrepancy in the number of pieces finished at the different operations.

The overhead cost includes unloading and transportation of all material from the railroad siding, loading of finished products, machine repair, toolroom operation, supervision and time-keeping. Power, fuel, raw material and new machinery are charged to a separate operating expense that is borne by the company. In buying new machines, the superintendent investigates the machine and the possible saving a machine will make, and then recommends the purchase to the main office, which places the order.

The system outlined has increased production, made possible a better product, increased earnings and made the foreman an important part of the organization. The idea, worked out by B. F. Hamilton, superintendent, is a simplified combination of several bonus plans in which he has participated.

Verifying Part Changes

By John F. Hardecker

"Do you remember Ed. Jones who was on the boards with us back in the old days at the Pyramid Plant?" queried Bill Smith of his friend and fellow chief draftsman Jack Brown. "Ran across him uptown the other day," he continued, "and went out to his plant, the Engle Aircraft Company, with him, where he is now Chief Draftsman. While there I noted one point in their system of getting engineering information to the inspectors in the shops that struck me as being particularly good.

"They use a system of project engineers on their jobs, each engineer being in charge of certain designs. When parts reach inspection and the inspector finds that in some respect they differ from the drawing, either through shop error or an inconsistency in the drawings, instead of coming to the office to locate the draftsman, or phoning him, which would get him only verbal instructions, he fills out a form 'Request for Engineering Information,' stating the model designation, part number, and describing the deviation, and forwards it in duplicate via the plant mail to the project engineer.

"The project engineer fills in his recommendation, and returns one copy to the inspector. This copy is the authority for acceptance or modification of the part as required. The other copy acts as the engineering record of the action, or as an order on the drafting room to change the drawing if it is in error. It puts the entire case down on the records in a practical way, and speeds up the procedure, as it eliminates the necessity of awaiting the reissue of the revised drawing."

A Variable Speed, Reversible, Hydraulic Power Transmission

A variable speed device without toothed gearing—Oil is the transmitting medium—Operates equally well in either direction—Simple operations in manufacture

THE universal hydraulic variable-speed gear is a device made by the Waterbury Tool Co. to transmit power at any speed from a standstill to maximum in either direction without changing the rate of speed or direction of rotation of the part to which power is applied and without the interposition of toothed gearing or other mechanical connection. The transmitting medium is oil, the direction and rate of flow of which determines the direction of rotation and speed at which power is delivered.

The device consists essentially of two rotating multiple-cylinder pumps with reciprocating pistons, both of which may be contained in one casing when a single-compact unit is desired, or may be separated by any reasonable distance and placed in any relative location that will permit the two parts to be permanently connected by suitable piping. When interposed in the drive of a standard machine as in Fig. 1, which shows its application to a small engine lathe in the shop of its builders, a constantly running pulley at the primary end derives its power by belt from an overhead shaft and power is taken off at the secondary end, in this case through a spur gear, to drive the machine.

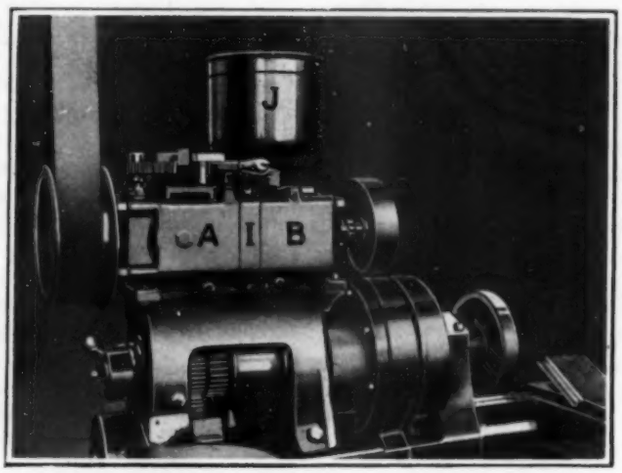


Fig. 1—Hydraulic transmission applied to lathe

Obviously, the manner of applying power at the one end and of taking it off at the other is not confined to belt and gearing. The primary end may be coupled to any form of prime mover that may be available, and the manner of taking power from the secondary end is equally flexible. In the above installation the single case, containing both revolving members of the device, is shown at *AB*, and the control is by means of the horizontally projecting lever *C* above the case.

With the lever in the position here shown the lathe remains stationary, even though the belted pulley runs at full speed. The operator, by drawing the handle of the lever toward himself, starts the lathe in forward motion, increasing the speed as the lever moves, until it reaches its limiting stop, when the gear at the secondary end is running in 1:1 ratio with the belted pulley. The same cycle of movements takes place in reverse direction when the handle is moved to the left of its central, or neutral, position.

The two mechanisms of which the device is composed are practically identical in construction with the exception of one important detail. While the stroke of the pistons in one of the units remains constant at a fixed maximum, the corresponding movement in the other unit may be varied at will from zero to maximum, and may also be reversed with relation to the time of passing a given point. To state the case a little more clearly, the primary end, called in the shop the "A-end," is a constant-speed but variable delivery pump, the rate and direction of flow from which is under control.

The opposite end, or "B-end," cannot rightly be called a pump, even though its parts and movements are practically identical with those of the A-end; as its function is that of a driving motor, deriving its energy from the flowing stream of liquid delivered by the pump. To avoid the confusion that would follow the use of the terms "driver" and "driven" in this connection we will for the purpose of this article designate the units as the "pump" and the "motor" respectively.

In Fig. 2 may be seen the active members of the pump and motor in one of the smaller sizes. Except for a very minor detail in the spacing of the cylinders and sockets with relation to each other and to the center of rotation there is no difference between them. Each consists of a shaft *D*, a cylinder barrel *E*, a swiveling socket-ring *F* which is attached through a universal joint to the shaft, and the pistons *G* with their connections. All of these parts are contained within a rectangular shell called the casing.

The cylinder barrel is splined to the shaft, to which it is fitted closely but not tightly enough to prevent end movement. The special form of universal joint connects the socket-ring to the shaft in such a way that the ring is constrained to rotate with the cylinder barrel but is allowed to take up its rotation in a different plane. The ring does not "wabble" as it revolves, but rotates smoothly in the fixed plane to which it is set. It will thus be seen that one revolution of the rotating unit causes each of the seven pistons (or nine pistons in the larger sizes) to pass through one complete cycle, forward and back, in its respective cylinder.

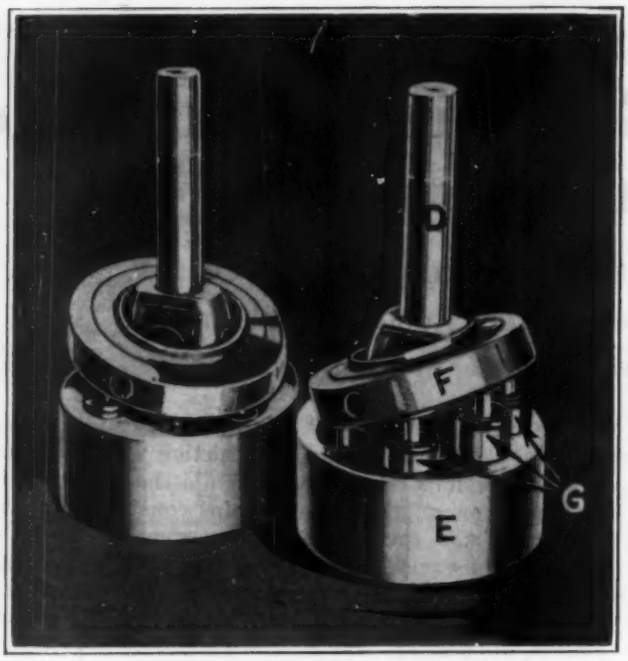


Fig. 2—The rotating members assembled

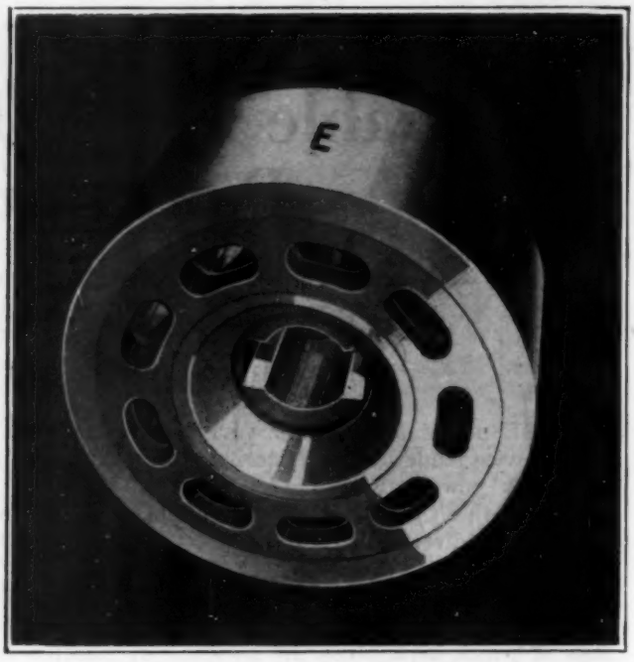


Fig. 3—Port end of cylinder barrel

The cylinders, which are plain bored and ground holes, do not extend all the way through the barrels, as may be seen in Fig. 3, but terminate at a given distance from the opposite face. A bored recess at the inner end of each provides for overrun of the abrasive wheel in the grinding operation, and also prevents the pistons from wearing shoulders in the cylinder walls by allowing them to overrun the recessed portion. The oblong ports through which the oil enters and leaves the cylinders may be seen in this illustration.

The manner of connecting the pistons to the socket-rings may be seen in Fig. 4, which shows two full sets of pistons and their connections. Each ring has a number of sockets corresponding to the number of pistons, and in each socket is pressed a bronze bearing seat, hemispherical in shape to match the ball end of the connecting rod. An annular bearing, also of bronze, encircles the rod behind the ball to prevent it from bounding out of its socket when the device is in motion. This annular bearing is necessarily in halves so that it may be placed in position to encircle the rod, as there is a similar ball at the other end of the rod which would prevent a ring bearing from going over that end.

The rods are held in the pistons in a similar way. Ring nuts are screwed into the piston and the socket-ring behind the annular bearings to hold them in place. As there is never any appreciable pull exerted by the pistons the duty of these bearings is light.

To insure ample lubrication to the rod bearings a small hole is drilled axially through the piston and its bronze bearing, and also lengthwise through the rod. Pressure behind the piston forces a minute quantity of oil through these holes to lubricate the bearings. The greater the power load upon the device the higher will be the pressure of oil behind the pistons, and therefore more oil will be delivered to the bearings under the conditions that makes more lubrication desirable.

The socket-ring of the motor-end is supported in a permanently inclined seat, called the angle-box, within the casing. As the thrust upon this part may be very severe, the radial and thrust roller bearings to be seen in Fig. 5 are interposed between the ring and the angle-box to take the load.

The main difference between the pump- and the motor-ends of the device is that in the former the socket-ring, instead of being seated against a permanently inclined bearing face, is carried in a swiveling member called the "tilting-box" by means of which its plane of rotation may be varied from coincidence with that of the cylinder barrel to maximum inclination of about 20 deg. in either direction. Fig. 6 shows the assembled rotor of the pump-end with its roller bearings in place; the casing *A*, with the tilting-box *H* ready to receive the bearings of the socket-ring; and a part *I*, called the "valve-plate."

The cylinder barrel, though splined to the shaft, is free to float endwise upon it, and does so float within very small limits in case of slight end movement of the shafts. The cylinder barrel does not take a bearing in the casing, there being a generous clearance between its periphery and the bore of the latter. The entire radial load of the revolving parts (except the socket-rings, which have their own bearings as before men-

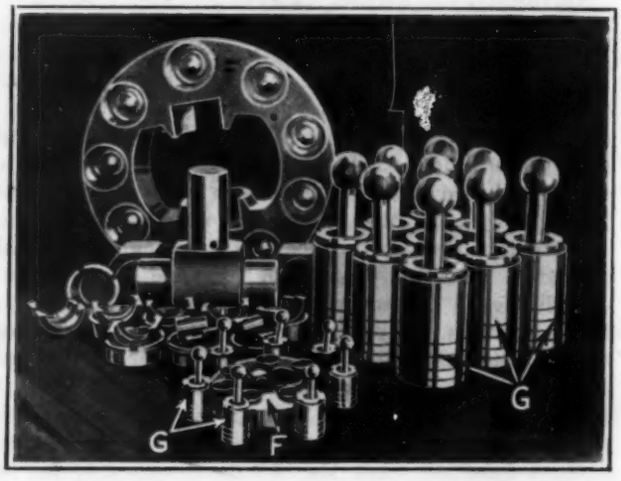


Fig. 4—Piston and socket ring assembly

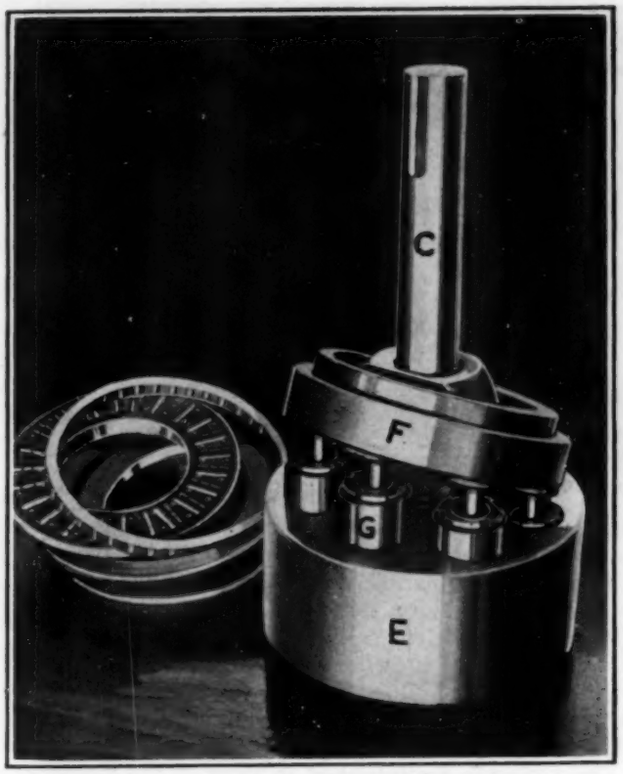


Fig. 5—Rotor of "B-end" with bearings

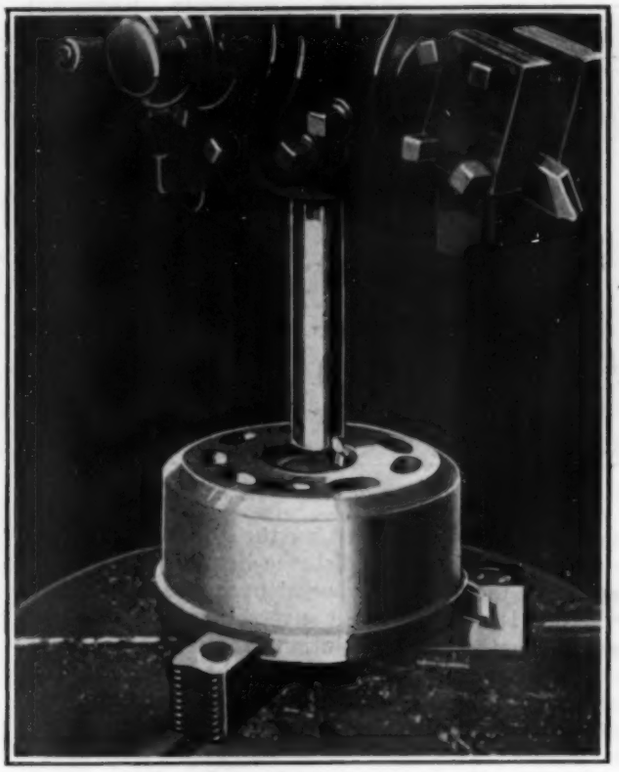


Fig. 7—First machining on cylinder barrel

tioned) is borne by the plain sleeve bearing in the stuffing box of the casing and by the radial roller bearing to be seen in place in the valve-plate.

When the rotor is placed in the casing and the latter closed by bolting the valve-plate to it, the port end of the cylinder barrel—seen in Fig. 3—bears against the annular seat of the valve-plate, thus preventing the escape of oil radially. A coil spring encircles the shaft beyond the cylinder barrel and holds the latter against the valve-plate with a slight pressure when the device is running idle. When under load the tendency of the barrel is to hug the plate more tightly as the pressure of the oil increases.

The reason for this latter condition is that the area of the port opening into each cylinder is less than that of the exposed end of the piston, and therefore as the pressure of the oil increases and tends to push the entire rotor away from the valve-plate there is always a slightly overbalancing pressure inside the cylinder at the port end tending to keep the barrel in contact. This excess of pressure is slight under any condition, and is but little greater under full load than at no load.

When both ends of the device are to be assembled into a single unit both sides of the valve-plate, *I*, Fig. 6, are alike and the communication between the pump and motor is by means of the semi-circular ports in this plate. When the ends are to be mounted separately, each casing has a head, or cover, of its own, with the valve face on the inner side, and these heads are connected by suitable pipes. The relative position of the ends in the latter condition is immaterial; the only disadvantage of a wide separation being the added friction of the flowing oil in a long and possibly tortuous pipe connection.

A study of the rotor as shown in Fig. 2 or Fig. 6 will disclose the fact that, as the assembled unit rotates, the pistons are continually working back and forth in their respective cylinders. When considered in relation to the valve-plate it will be seen that the pistons are moving outward while passing one of the semi-circular ports of the valve-plate and inward while passing the other port. Further, while the ports of the cylinders are passing the closed spaces between the ports of the valve-plate the pistons are, so-to-speak, on dead center at one end or the other of their stroke and no transmission of oil takes place at the moment.

The oil being delivered by the pump pistons, passing through the port of the valve-plate, exerts pressure upon the exposed end of the motor pistons. Through the pistons and their connections the energy is transmitted to the socket-ring, which, by virtue of its inclined position, is caused to rotate and carry with it the shaft and cylinder barrel.

A given piston, therefore, moves outward in its cylin-

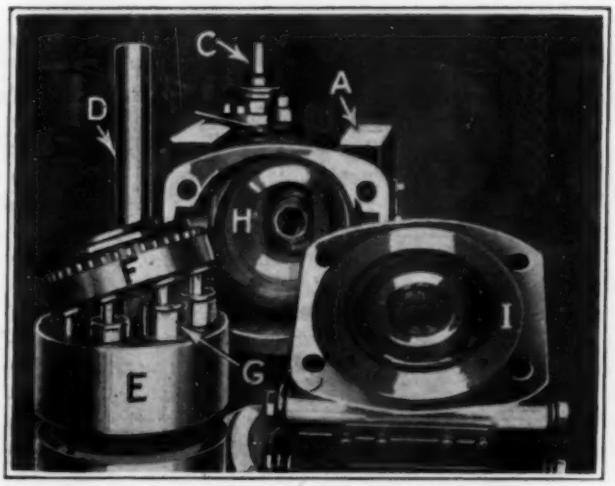


Fig. 6—"A-end" partly disassembled

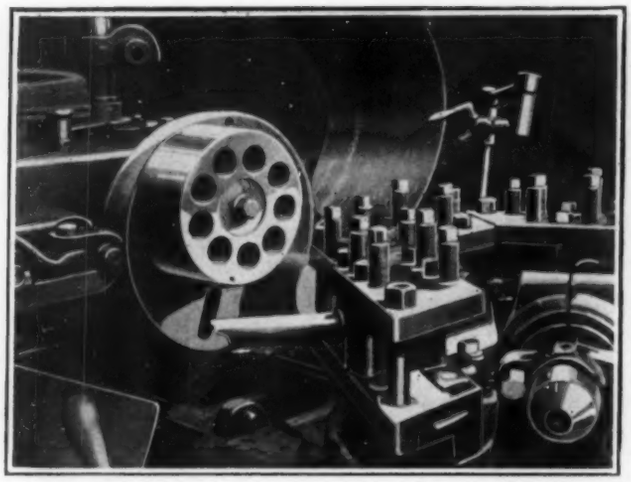


Fig. 8—Boring the cylinders on J. & L. machine

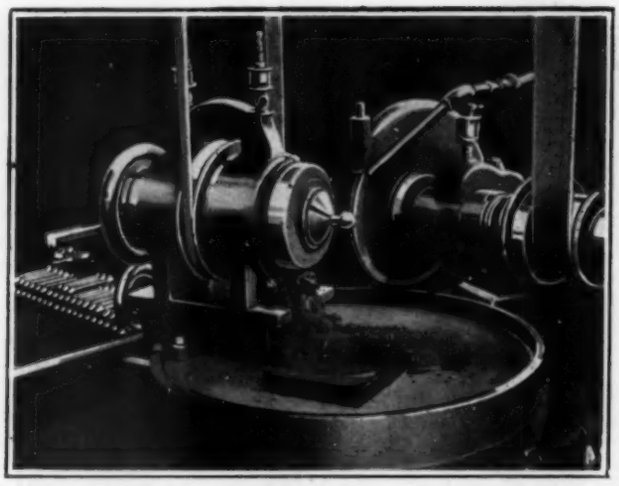


Fig. 10—Machine to grind ball ends of connecting rods

der while the rotor is passing through that half of a revolution in which the distance between the cylinder barrel and the particular socket upon which the piston is acting is increasing. Conversely, while the rotor passes the other half-revolution the aforesaid distance is decreasing and the piston moves back to its original position, expelling the oil in the cylinder; but at the instant of reversal of the piston movement the port of its cylinder passes the dividing wall between the incoming and outgoing ports of the valve-plate and the expelled oil is therefore being delivered at no pressure to what is for the moment the suction side of the pump.

When the suction and delivery sides of the pump are transposed by moving the tilting-box to the opposite side of its neutral position the direction of flow of the oil is reversed, and with it the direction of rotation of the motor.

The combined displacement of all pistons in the motor-end must always equal the combined displacement of all pistons in the pump-end. Therefore, if the pump pistons are reciprocating at full amplitude the two units must rotate in 1:1 ratio. If the angle of the tilting-box be reduced so that the amplitude of stroke is but one-tenth of the full amount, the amount of oil delivered by the pump is reduced in proportion. As the total displacement of the motor pistons per revolution of the unit remains the same, it follows that the speed of rotation will fall to one-tenth, because there is but one-tenth of the amount of oil to be taken care of in a given time.

It will be seen, then, that while the tilting-box of the pump-end holds its socket-ring at right angle to the axis of the shaft and the plane of rotation of the ring is in consequence parallel to that of the cylinder barrel no movement of the pistons will take place and no oil will flow. As the tilting-box is tipped to an angle of other than 90 deg. with the axis of the shaft the pistons begin to move and oil is passed to the motor in increasing quantity as the angle of inclination departs from 90 degrees.

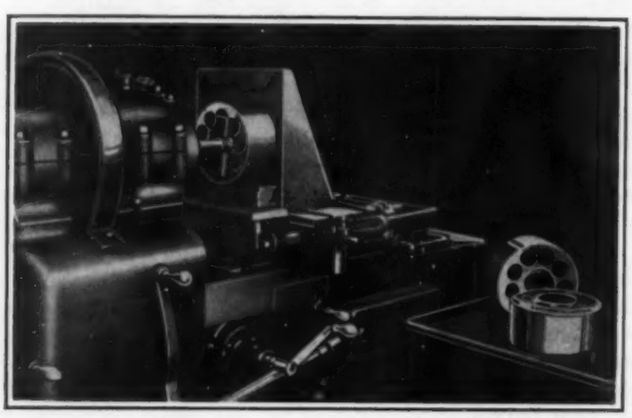


Fig. 9—Grinding cylinders on Heald machine

The tilting is accomplished in some of the machines by means of a lever and in others a screw-operated movement is provided; the screw shaft extending from the top of the casing as at *C* in Fig. 6, and terminating in a handwheel. Under test, these devices must start, stop and reverse without shock or jar, and must run smoothly at a speed of one revolution per minute, with the pump end running at full speed.

The casings are completely filled with oil, the level of which is allowed to rise to a point about midway of the height of a small expansion chamber (to be seen at *J* in Fig. 1) above the device. This expansion chamber is provided to take care of volume changes as the temperature of the oil rises and falls. Contrary to what at first might be concluded, there is no pressure in the casings except that provided by the head at the expansion chamber. The only pressure in the device lies between the two cylinder barrels and in the passages of the valve-plate; and that pressure is always directly proportionate to the load that is being transmitted.

Though the load pressure upon the oil may at times rise as high as 1,000 lb. per sq.in., there is never any end thrust except that borne by the roller bearings of the socket-rings and by the valve-plate. The first is amply distributed by the large diameter roller thrust bearing; the second is negligible. There will always be a slight leakage of oil from the pressure system to the inactive oil in the casing, but this leakage is constantly being returned to the no-pressure side of the active system by non-return check valves.

Considering the difficulty experienced by builders of automotive engines and other types of machinery employing reciprocating pistons in guarding against undue leakage, a similar difficulty might reasonably be anticipated—and, indeed, *was* anticipated—by the builders of this device. Pistons were carefully lapped, each to its individual cylinder, but the only trouble encountered was the occasional sticking of a piston and the

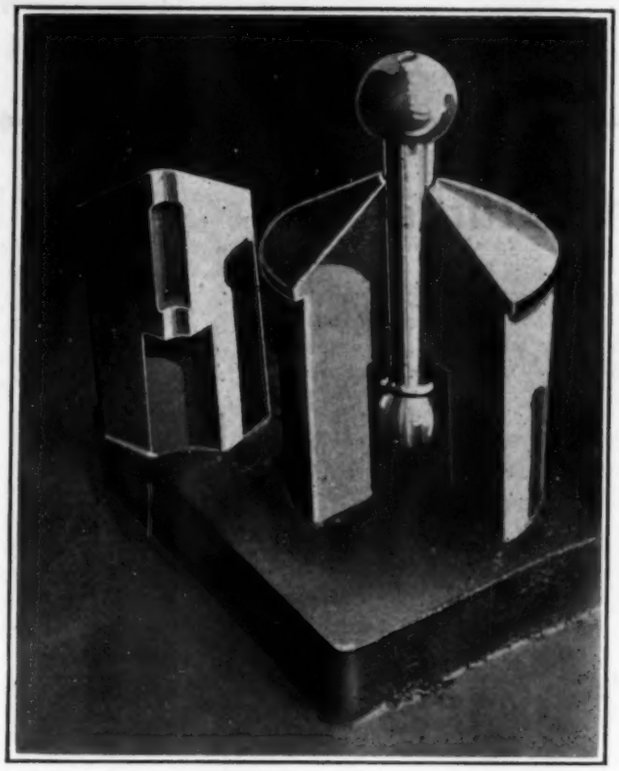


Fig. 11—Split bushing to hold rods in collet

lack of interchangeability. As now made, the pistons are merely round plugs of cast iron, ground to a size that is 0.001 in. per inch of diameter under the ground bore of the cylinder. Both diameters are ground to gage and there is no fitting.

There are no piston rings or other devices to make a tight joint; merely three or four very narrow and very shallow grooves turned in the periphery of the pistons to break up the streamlines of escaping oil.

The methods of manufacture are very simple, the greatest difficulty experienced being to secure good castings for the cylinder barrels and valve-plates. As these parts are called upon to withstand heavy pressure it is very necessary that the castings shall be free from blowholes and other imperfections, and that the iron shall be homogeneous and as nearly non-porous as possible.

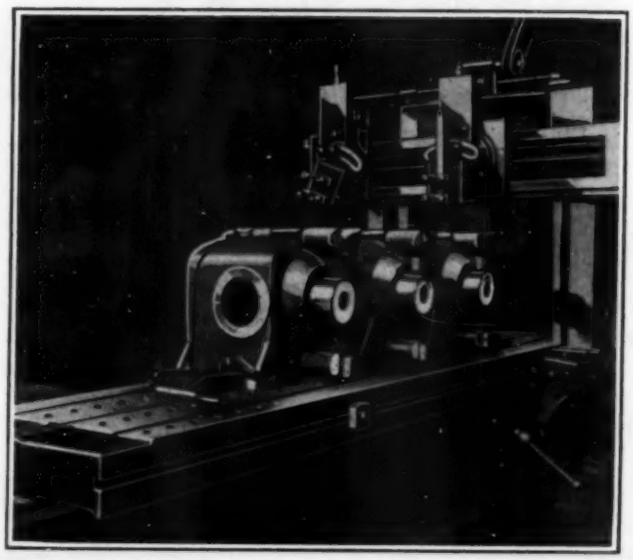


Fig. 12—Casings on the planer

The barrel is first machined all over in a Bullard vertical turret lathe as in Fig. 7, after which the splined central hole is broached and the finishing cuts made with the piece mounted upon a special arbor in an engine lathe. The precise location of the cylinder bores is of greater importance than would at first appear, as the relative location of these bores affects the smoothness of running. Contrary to what might be expected, the bores are not evenly spaced about the axis of the barrel; the variation being in relation to the position of the universal joint which drives the socket-ring.

The holes are first rough bored on a radial drilling machine through jigs or templets that are located from the splineways in the central bore. The casting is then swung up on the faceplate of a J. & L. flat turret machine as in Fig. 8, or on the table of a boring mill, where each bore is successively located by a large conical plug held in the turret and is then bored to grinding size. The bores are finished by grinding them to size upon a Heald cylinder grinding machine, each bore being set individually by the operator. A 3846 alundum wheel of grade J or K is used.

The ball-end connecting rods are made from drop forgings and are machined all over, pack-hardened, and ground. The forgings are first centered and the small oil hole drilled through lengthwise. They are then turned on centers to match a templet, after which they are hardened and taken to the grinding machines.

The special machine that was designed to grind the ball ends of the rods is shown in Fig. 10, and Fig. 11 is the removable split bushing by which they are held in the work spindle of the machine. Because of the ball on each end of the rod the separable bushing is necessary. After loading as shown in Fig. 11 it is held in the work spindle by the usual form of draw-in collet, operated by a handwheel at the rear end of the spindle.

The round table of the machine oscillates about its axis, being driven through a pair of bevel gears from a shaft that is provided with a reversing clutch. The amplitude of the oscillating movement is determined by the setting of dogs on the periphery of the table.

The center of the ball to be ground must be in vertical alignment with the center of oscillation of the machine table. The actual length of the rod, measured from center to center of the balls, is not of extreme importance, as there is ample leeway in the difference between the depth of the cylinder and the length of stroke of the piston to accommodate any slight variation that may occur. Fig. 12 shows a row of casings set up on a planer for the preliminary work.

This type of power transmission is applicable to almost any kind of machinery that requires minute graduations of speed without shock or jar, and particularly where a reversal of direction is necessary. It is built in sizes from 15 to 200 hp. and its application ranges from the small lathe shown in Fig. 1 to gasoline-propelled railroad cars. In the latter service a single A-end, or pump, is directly connected to the power unit on the floor of the car, and the oil is piped to two smaller B-ends, or motors, located on the trucks.

The device has been in service in the U. S. Navy for over twenty years for such purposes as elevating big guns, turning turrets, and operating capstans and winches. It is also in extensive use to transmit the power necessary to operate the steering gear of large vessels.

THE · FOREMAN'S · ROUND · TABLE

Picking Assistants

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SAY, Al," said Ed to his fellow foreman, "the boss wants me to pick a man for sub-foreman and I don't just know who to pick. First I thought I'd suggest Jim Brown and then I remembered the mess he got into when we sent him on that repair job. He's a nice chap, belongs to my lodge, and always votes a straight ticket. Guess he'd average up with the rest but I'd like to be able to forget about that repair job."

"What's the matter with little Billy Watson, Ed? He's a likeable chap and ought to get on well with the men."

"Why, Watson pulled a bone last week and the boss wouldn't hear of it, I'm sure. He has been a good man on most work, mighty dependable and always on the job. But the boss happened to know about this particular bone Billy pulled and I don't believe he'd stand for him as sub-foreman."

"Seems to be more a case of remembering, Ed, than of ability. If you think you are going to be able to pick a man who has never made a mistake, you're going to have a heck of a time doing it. Angels don't seem to grow in this neck of the woods, Ed."

"Don't know as we'd want an angel anyhow, Al—he wouldn't be happy in our joint very long. What I'd like to get is a chap who can push the work out in a hurry. Guess the boys know me too well and think I won't keep after 'em too much. Might be a good plan to get someone from the outside that none of the boys know so well."

"That's where I think you're on the wrong track, Ed. The minute you go outside for a foreman you notify your men that there's nothing ahead for them in your shop. And the 'going-to-be-foreman-or-bust' type of men leave you for some other shop. I believe I can get out more and better work by having the men interested in both the work and in me, than any of the foremen who push and drive."

"There's another thing, Al, that I'm not dead sure about. S'pose the Old Man just wants me to have a man ready to take my place if I fall down on some job. Has he asked you to pick out an assistant?"

"No, he hasn't, Ed. But he knows that I have two or three men who could run the department in case of emergency. The Old Man isn't after your scalp as long as it's glued on tight, and he doesn't do things behind your back, anyhow. Every foreman ought to have one or two men who can handle his job in case of necessity."

"Well, I suppose I'll have to pick out a man, Al, but I'm not a bit keen about it. I don't just like the idea of picking out a man to take my job."

How should Ed pick an assistant?

Should he keep a record of a man's work or go by what he happens to remember?

Is Al wise in having men who can keep things running if he's away?

Is Ed justified in being afraid to pick an assistant?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Where Shall We Start Apprentices?

FROM my own experience as an apprentice and from contact with apprentices today, I feel that assembly work should come during the last six months. While assembly work is very important and usually done by the best men in the shop, it is apt to be very uninteresting to an apprentice in the early stages of the game. The apprentice often lacks the patience required to fit, scrape and file parts to the satisfaction of a fussy and particular fitter or assembler. He often becomes discouraged and quits before he begins operating any machines. It is just as easy to teach the names of parts of machines while they are being manufactured as it is while they are being assembled. It is up to the foreman or instructor to explain to the boy at the time the job is handed out, the requirements as to accuracy and why those requirements are necessary.

A big factor in keeping boys interested and "on their toes," is to grade the work assigned as much as the general run of work in the shop will permit. It generally makes a wide-awake boy feel that he isn't progressing very fast if he is covering the same old ground very often.

As a journeyman one must generally take whatever the line of work happens to be and do the dirty job just as cheerfully as the better grade of work, but for the apprentice the jobs ought to be in a fairly good order of progression.—WALTER E. SCHOBER, *Drafting Instructor.*

Letting the Man Try His Own Way

THE foreman who arbitrarily insists on having his men do each job in the way he is told to do it is publicly confessing his own lack of ability. To insist on it is to rob the man of his initiative and incentive, and to make of him merely another machine on the job. Though he is being paid for the use of his head as well as his hands, only his hands are being utilized. The worker then puts in so much time for so much money.

On the other hand, to let the man change from his instructions at will is just as bad, if not worse. The men will not only lose respect for the foreman, but also for the organization. The right thing to do is to allow the men to feel free at all times to discuss other ways with the foreman and, if they can show him the advantage, to have him approve the change. The success of this plan depends, to a great extent, on the foreman's own attitude. Fundamentally it is a question of co-operation. If this spirit can be successfully created, not only will discipline be maintained but worth while improvements will be developed and the workmen will be encouraged to use their heads as well as their hands.
—FRANK KAHN.

Where Shall We Start Apprentices?

IN THE course of their discussion, Al and Joe suggested two methods for the training of apprentices. A third method might have been suggested by them. This one, which was common under the old-time system of apprenticeship, consisted of starting the boy on sweeping the floor and keeping things clean.

The average age at which to start an apprenticeship, if we consider all periods of history about which we have evidence, is at about twelve years. The boy of this age is curious and restless. If he is started on the lathe, he is interested in everything else but the lathe. Compared with the boy of eighteen, he is more interested in accomplishing results than in the process by which the results are secured.

Sweeping the floor shows immediate results and is not likely to result in spoiling valuable materials. It is work in connection with which there is rational discipline, something more than simple obedience.

The next place for the younger boy after a short time in the shop is that of painting, crating and shipping the finished machines. It has variety enough to satisfy his restlessness and it gives him an opportunity for individual judgment and initiative. This would not be true if the quantity of duplicate articles were large, but it is even then better than to start on a machine such as a lathe. The boy of eighteen has learned routine in school and he, therefore, does better in operating machines.—A. W. FORBES.

Where Shall We Start Apprentices?

THERE is no plan for training apprentices that will fit all cases. No. 1 boy may be determined and resourceful. No. 2 boy may require following up. The first will be found scouting for information. The second will have to be told.

It is wrong to give the apprentice an opportunity to evade the dirty, tedious job. What is meant by a "real" job? The dirty one of cutting threads is the real one. A pie cannot be baked without a crust. Of course the boy should be shown the machine for which he is making parts, but each individual needs different training. They must be studied in order to see what kind of work they need, especially to make them into finished mechanics.—STORRS T. RICHMOND, *Master Mechanic.*

THE · NEXT · TOPIC

Assigning Work to Machines

QUESTIONS

What are the advantages of planning boards?

Should the department foreman have anything to say about what machine to use for each job?

How does a planning board show up the slow operators?

Ideas from Practical Men

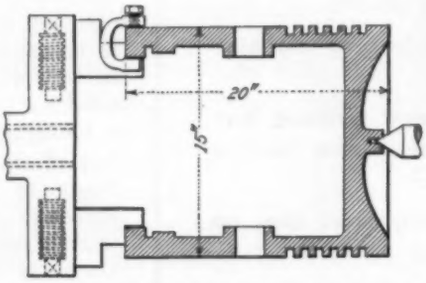
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Clamp Aids in Driving Chucked Work

By Arthur Silvester

Where large pistons, sleeves or similar parts are to be turned, there is generally considerable stock to be removed, and care must be taken not to hold the work too tightly by the chuck jaws, otherwise it will be out of round when released.

A simple method of helping the chuck to drive such work is shown in the illustration, which represents a piston weighing over 300 lb. in the rough. A C-clamp is attached to the work, against one of the chuck jaws, and will do most of the driving. With the work so driven, heavy cuts can be taken at coarse feeds without fear of its slipping. After the roughing cut has been taken, the clamp can be removed and a cut taken over the part obstructed by it.



Using a clamp to drive chucked work

The finishing cut can be taken without putting on the clamp again, since a light pressure of the jaws will be sufficient for driving. However, the clamp should be in place when cutting the grooves, especially if they are all cut at once by a multiple tool.

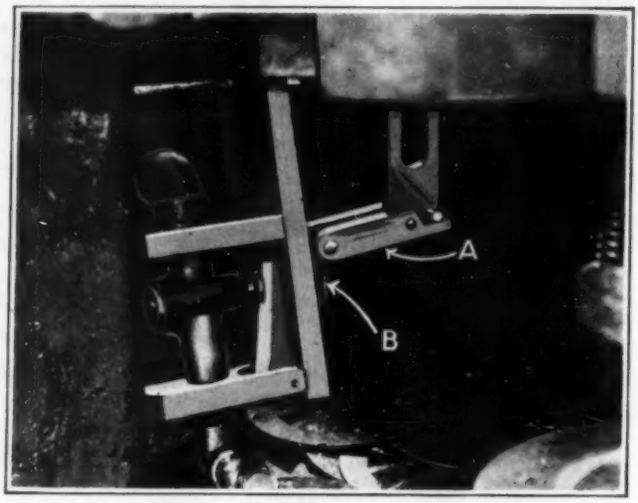
Adjustable Valve Opener for Air Jet

By Henry Densmore

For much of that class of press work known as "second" operations, which includes pretty much everything except blanking, the work is usually fed to and removed from the tools by hand.

If the pieces to be handled are light, there is nothing more satisfactory than a jet of compressed air to remove them from the tools, but in order to be effective and at the same time economical in the use of air, the jet must be delivered in a sharp puff at the right moment, which is just as the tools separate and the work is partly lifted from the die by the upper tool. An instant later the piece will have fallen back on the die, from where it is not always easy to dislodge it.

The illustration shows the means employed in the press shop of the Westinghouse Electric & Manufacturing plant at East Springfield, Mass., to deliver the puff of air at the right time. The piece *A* is a swinging



Valve-opening device, adjustable for time

latch, adjustably attached to the ram of the press. The piece *B* is a hinged lever to press against the button of the air valve.

As the ram descends, the latch *A*, contacting with the lever *B*, is lifted and passes over the lever without disturbing it. At the bottom of the stroke the latch drops back by gravity to the position shown, but below the face of the lever. On the upward stroke the latch pushes the lever back for an instant and thus opens the valve.

The air nozzle is fixed beside the die in the position where it will be most effective. The simple adjusting feature of the latch holder allows the moment of opening the valve to be timed so that the air jet will catch the piece before it has fallen back on the die.

Acquiring the Knack of Freehand Lettering

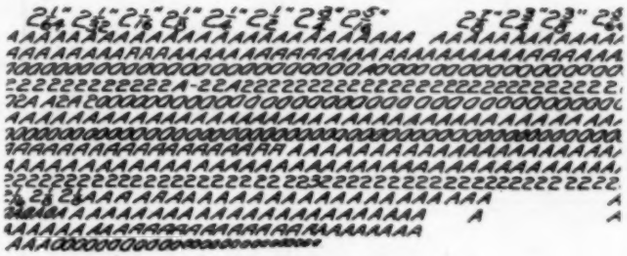
By Frank W. Bentley

I am not a professional draftsman. I have never worked in a drawing room. I can, however, make a sketch, and detail, trace and print a drawing as well as the average draftsman.

Freehand lettering was my greatest trouble in the little university of hard knocks, where most of my experience was secured. It is a "hoo-doo" to a lot of us, and is something we generally do the least of, yet it is an essential part of a practical, readable drawing.

Lettering practice over the drawing board is really tedious, tiresome work. The body soon tires and proficiency is not rapidly or easily acquired.

The method I used to acquire the finger cunning with pen, to make neat, regular letters and figures can be followed by any one. Take a soft pine board not larger than 12x12 in. Lay a set of ruled guide lines on the board, over which can be tacked a narrow strip of tracing cloth. The board can readily be placed in any position most comfortable to the arms, eyes, and the rest of the body. Laid flat on a table, a reading glass



One of the practice strips

can be held in the left hand, as the letters are made over and over again. The eyes, as a result, will not tire, and interest in the work is easily sustained.

It was my practice to take one letter an evening, and fill a strip with nothing but this one character; for a perfect, rapidly-made letter is the result of shaping and making it many, many times, as shown in the illustration.

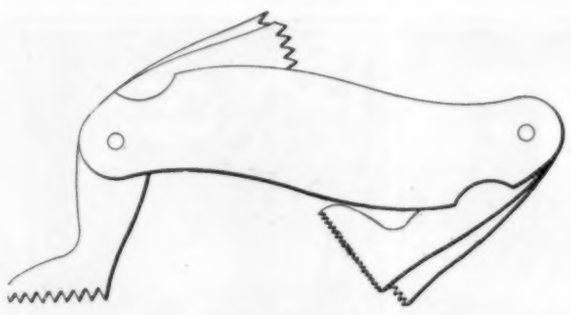
With the board laid on a table, and the light properly adjusted to the paper and glass, a half hour's practice was actually enjoyed. The improvement was rapid and satisfying.

Others may or may not approve of this method. However, adherence to it changed my lettering from characters akin to Egyptian hieroglyphics into freehand printing not to be ashamed of. Try it.

A New Use for an Old Tool

BY GEORGE CONOVER

For the benefit of those draftsmen who still follow the laborious method of stepping off threads with the small dividers, there is nothing more efficient and time-



How the thread gage is used

saving than the use of the ordinary machinists' thread gage, as illustrated.

The leaf with the desired number of threads per inch is quickly found, and a slight pressure on the paper steps off at least half dozen thread spaces at once—quickly and accurately.

Either a gage for sharp V-threads or one for U. S. S. threads can be used.

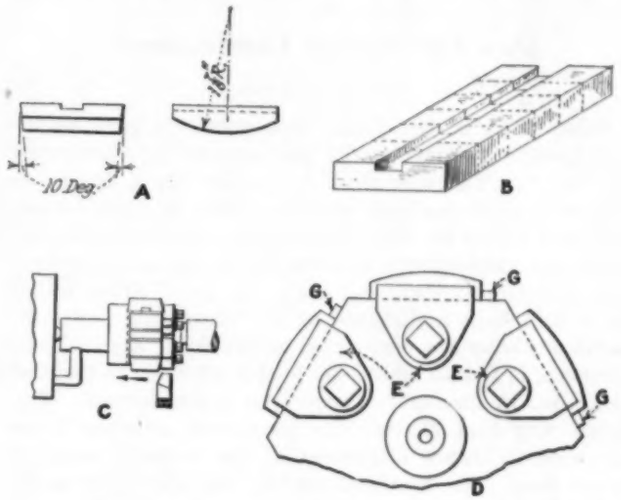
Turning Instead of Form Milling

BY GEO. H. NOEL

The work shown at *A* in the illustration is made from a flat bar of cold-rolled steel, first machined in vise jaws to the form shown at *B*, and the edges then milled to a 10-deg. bevel. The strip is then cut into six pieces, as indicated. Formerly each piece was form milled with a concave cutter of 1¾-in. radius.

The milling process was rather slow, so to improve production two special arbors were made, each holding six of the pieces as shown at *C*, the pieces being turned in a lathe to the proper radius.

An enlarged end view of the arbor shown at *D* gives an idea of the construction. The pieces are located on one of the angular faces and are clamped against the



Arbor for turning parts that were formerly milled

collar by six clamps *E* at the outer end of the arbor. In order to make provision for driving, two pins, *G*, were inserted at each station. The operator loads one arbor while the lathe is working on the other, so there is very little lost time. The milling method produced 30 pieces per hr., but with the lathe the production was increased to 120 per hour.

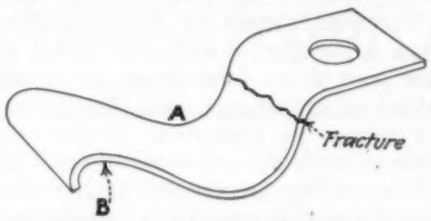
Hardening and Tempering Flat Springs

BY NICHOLAS DOWNING

Considerable difficulty was found in tempering the flat steel springs shown at *A*. The service the springs had to undergo was such that sudden pressure was frequently applied to the point *B*, and the springs had to be tempered very carefully to obtain the required toughness and resiliency. Breakages were of frequent occurrence when the springs were hardened and tempered. They were heated two at a time on a wire hook, in a gas flame; then quenched in water, and afterward drawn to a blue color in a pan of hot sand. Since they were made only in small lots two or three times a year, no one had ever taken the trouble to solve the difficulty, so every spring was tested in a fixture before sending it to the assembling department. Frequently 25 per cent or more would break in the test.

To overcome the trouble, several lots of twelve springs each were heated in a barium chloride bath, at tem-

peratures ranging from 1,250 to 1,500 deg. F., quenched in water and then drawn in oil at temperatures varying from 450 to 600 deg. Eventually it was found, after recording the various tests and making the usual drastic attempts to break the springs, that a very tough and resilient spring was obtained by the following treatment. A good method of tempering springs is to heat them in barium chloride for 20 seconds at 1,350 deg. F. and quench in water. Draw them in oil at 580 deg. F. for 30 sec. and allow them to cool slowly.



The spring to be heat-treated

Dies for Starter Laminations

By L. L. Locke

Press tools of the pillar type used for perforating and blanking starter-motor laminations are illustrated in Fig. 1. The operation is handled in a Henry & Wright dieing machine equipped with a double-roller feed that passes the work through the dies automatically. When the stock enters the first die, it has a ½-in. center hole and twenty-eight coil slots cut in it, after which it is fed along a distance of 2⅞ in. where two ½-in. guide-pin holes are perforated on the outer edge. Then the stock is fed an additional length where it is blanked to 2½ in. in diameter, completing a lamination. The guide pins that fit into the previously punched holes are used to insure alignment of the blank in relation to the slots. The material used is "electric" sheet steel, 0.022x2⅝x96 in. in size. As the scrap material passes through the roller feed, it enters a stock-cutter that reduces it to small pieces in order to reduce its bulk and to facilitate handling.

Constructional details of the dies are shown in Fig. 2. The work passes between the dies *A* and the stripper *B*. In making the slot punch assembly, the punches *C* are fitted with slight clearance into the punch holder *D*, and then lined in place by inserting their projecting ends into the die. The punches are "leaded" in place while in this position. The upper end of the holder is made with pockets such as shown at *E*, so that a solid connection is obtained. A pin is placed in the upper end of each punch to position it vertically. As the blanking punch *G* perforates its work, the blank is forced through the die *H* and over the rod *K* stacking the work uniformly. This feature may be seen in Fig. 3, which shows a quantity of finished laminations in place at *A*. Scrap produced by the punches falls in the tote-box shown on the floor.

The machine is of 50-tons rated capacity, and the production is approximately 4,000 laminations per hour.

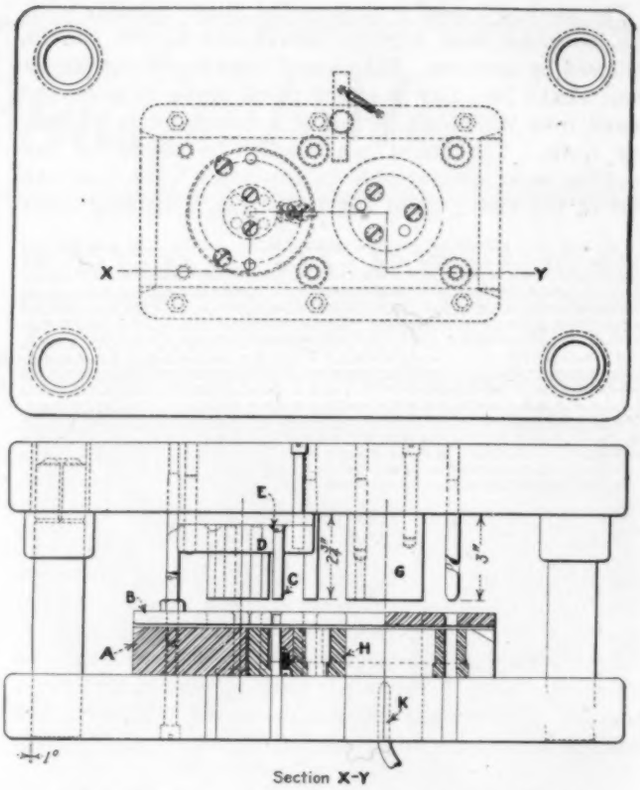
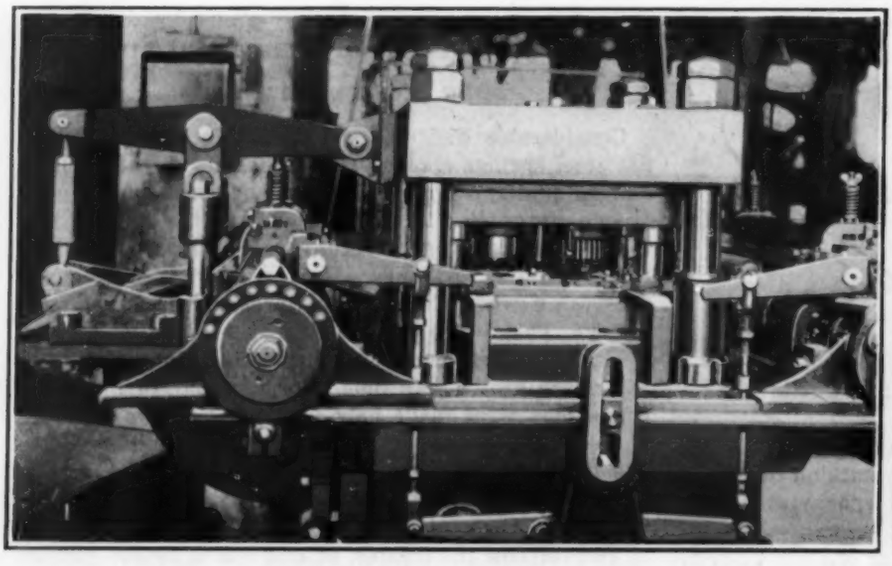


Fig. 2—Constructional details of die assembly



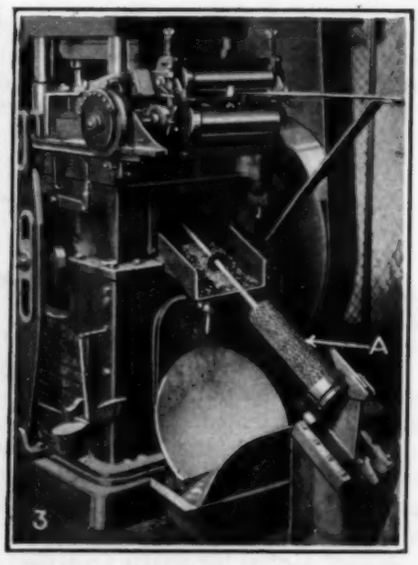


Fig. 1—Compound die for perforating motor laminations. Fig. 3—Method of stacking work

Standard Wrought Iron and Steel Pipe Sizes

Size, Nominal Inside Diam., Inches	Outside Diam., Inches	Approximate Thickness, Inches	Nominal Weight per Ft., Lb.	Approx. Internal Diam., Inches	Internal Area of Section, Sq.In.	Threads per Inch, No.	Length of Perfect Thread, Inches	Total Length of Thread, Inches	Depth of Thread, Inches
"Standard Weight" Pipe									
⅛	0.405	0.068	0.244	0.269	0.057	27	0.19	0.412	0.029
¼	0.540	0.088	0.424	0.364	0.104	18	0.29	0.624	0.044
⅜	0.675	0.091	0.567	0.493	0.191	18	0.30	0.630	0.044
½	0.840	0.109	0.850	0.622	0.304	14	0.39	0.819	0.057
¾	1.050	0.113	1.130	0.824	0.533	14	0.40	0.832	0.057
1	1.315	0.133	1.678	1.049	0.864	11½	0.51	1.031	0.069
1¼	1.660	0.140	2.272	1.380	1.495	11½	0.54	1.055	0.069
1½	1.900	0.145	2.717	1.610	2.036	11½	0.55	1.071	0.069
2	2.375	0.154	3.652	2.067	3.355	11½	0.58	1.104	0.069
2½	2.875	0.203	5.793	2.469	4.788	8	0.89	1.638	0.100
3	3.500	0.216	7.575	3.068	7.393	8	0.95	1.700	0.100
3½	4.000	0.226	9.109	3.548	9.886	8	1.00	1.750	0.100
4	4.500	0.237	10.790	4.026	12.730	8	1.05	1.800	0.100
5	5.563	0.258	14.617	5.047	20.006	8	1.15	1.906	0.100
6	6.625	0.280	18.974	6.065	28.891	8	1.26	2.013	0.100
8	8.625	0.322	28.554	7.981	50.027	8	1.46	2.213	0.100
10	10.750	0.365	40.483	10.020	78.855	8	1.68	2.425	0.100
12	12.750	0.375	49.562	12.000	113.097	8	1.88	2.625	0.100
"Extra Strong" Pipe									
⅛	0.405	0.095	0.314	0.215	0.036	27	0.19	0.412	0.029
¼	0.540	0.119	0.535	0.302	0.072	18	0.29	0.624	0.044
⅜	0.675	0.126	0.738	0.423	0.141	18	0.30	0.630	0.044
½	0.840	0.147	1.087	0.546	0.234	14	0.39	0.819	0.057
¾	1.050	0.154	1.473	0.742	0.433	14	0.40	0.832	0.057
1	1.315	0.179	2.171	0.957	0.719	11½	0.51	1.031	0.069
1¼	1.660	0.191	2.996	1.278	1.283	11½	0.54	1.055	0.069
1½	1.900	0.200	3.631	1.500	1.767	11½	0.55	1.071	0.069
2	2.375	0.218	5.022	1.939	2.953	11½	0.58	1.104	0.069
2½	2.875	0.276	7.661	2.323	4.238	8	0.89	1.638	0.100
3	3.500	0.300	10.252	2.900	6.605	8	0.95	1.700	0.100
3½	4.000	0.318	12.505	3.364	8.888	8	1.00	1.750	0.100
4	4.500	0.337	14.983	3.826	11.497	8	1.05	1.800	0.100
5	5.563	0.375	20.778	4.813	18.194	8	1.16	1.906	0.100
6	6.625	0.432	28.573	5.761	26.067	8	1.26	2.013	0.100
8	8.625	0.500	43.388	7.625	45.663	8	1.46	2.213	0.100
10	10.750	0.500	54.735	9.750	74.662	8	1.68	2.425	0.100
12	12.750	0.500	65.415	11.750	108.434	8	1.88	2.625	0.100
"Double Extra Strong" Pipe									
½	0.840	0.294	1.714	0.252	0.080	14	0.39	0.819	0.057
¾	1.050	0.308	2.440	0.434	0.148	14	0.40	0.832	0.057
1	1.315	0.358	3.659	0.599	0.282	11½	0.51	1.031	0.069
1¼	1.660	0.382	5.214	0.896	0.630	11½	0.54	1.055	0.069
1½	1.900	0.400	6.408	1.100	0.950	11½	0.55	1.071	0.069
2	2.375	0.436	9.029	1.503	1.774	8	0.58	1.104	0.100
2½	2.875	0.552	13.695	1.771	2.464	8	0.89	1.638	0.100
3	3.500	0.600	18.583	2.300	4.155	8	0.95	1.700	0.100
3½	4.000	0.636	22.850	2.728	5.845	8	1.00	1.750	0.100
4	4.500	0.674	27.541	3.152	7.803	8	1.05	1.800	0.100
5	5.563	0.750	38.552	4.063	12.966	8	1.16	1.906	0.100
6	6.625	0.864	53.160	4.897	18.835	8	1.26	2.013	0.100
8	8.625	0.875	72.424	6.875	37.122	8	1.46	2.213	0.100

The above simplified practice standards have been accepted by a general conference of manufacturers, distributors, and users of wrought iron and wrought steel pipes, valves, and fittings, acting through the Bureau of Standards, U. S. Department of Commerce. These pipe sizes have been accepted as standards for new production starting Sept. 1, 1926. All intermediary sizes have been discarded. Lengths are "random," from 18 to 20 ft., according to present pipe mill practice. The permissible variation in weight is 5 per cent above and 5 per cent below that given in the table for "Standard Weight" and "Extra Strong" pipe, and 10 per cent above and 10 per cent below for "Double Extra Strong" pipe.

© American Machinist

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Forging Electrically Welded Steels

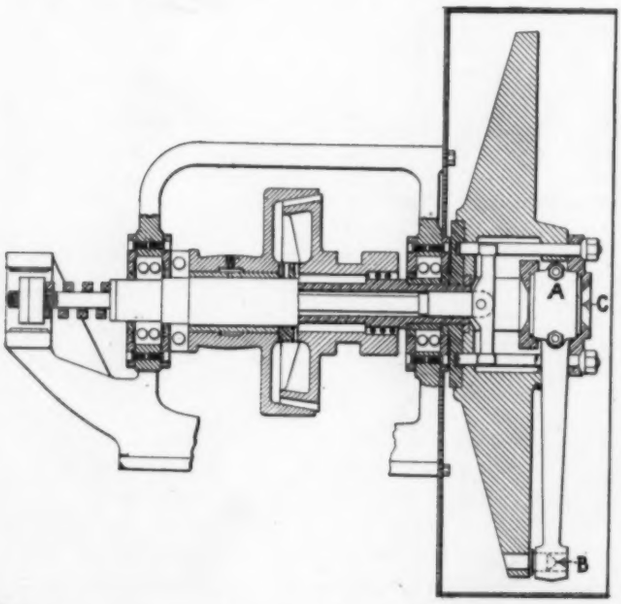
Q. Is it practical to hammer or roll an electrically welded piece of tool steel?

A. Hammering and rolling can be done on electrically welded steel with good results provided that the steel is normalized or annealed after the welding operation. If, however, the weld is between two different grades or classes of steel, trouble from breaks is likely to be encountered. This also holds true on welds where the welding rod employed is of a different composition from the steel parts. It must be borne in mind that the steels of varying compositions require different heats and separate forging treatments to suit their varying malleable properties.

Centrifugal Babbitting of Bearings

Q. I am the owner of a large garage, and am continually pouring bearings, but they are not as good as the ones made in the factory, although I take every care in the pouring. Can you give me data on the method used in the original babbitting?

A. The centrifugal method shown in the accompanying illustration is advocated by some of the well-known manufacturers. The connecting rod is mounted in the fixture with the bearing end to be babbitted at *A*, and



the crank pin end located on the pin *B*. The fixture is rotated at a speed of 500 r.p.m. The babbitt is poured into the bearing through the center hole *C* from a ladle containing just the proper amount of molten metal. The centrifugal force acting on the babbitt produces a bearing with a uniformly clean central bearing surface. The acid solution employed for cleaning the connecting rod bearing surface is made up in the proportions of 7 lb. of zinc chloride, 10 lb. of sal ammoniac, and 7½ qt. of muriatic acid, diluted with water enough to make 5 gallons.

Soldering Aluminum

Q. Can you give me a method by which good soldered joints may be made between aluminum parts?

A. Aluminum can be soldered without a flux by using a special aluminum solder. The surface is first cleaned with a file, and heated. It is then "tinned" by rubbing the solder into it. The actual soldering is done on the tinned surface.

Several aluminum soldering fluxes and solders are on the market, which are claimed to give better results than obtained by the "tinning" method. The directions given for the use of one of these fluxes is to clean the surface, and paint with a 20 per cent solution of hydrofluoric acid. The acid should be left on the surface for a few moments before washing off. The flux is heated until it flows freely, and coated over the surface. The parts are then heated until the solder melts when rubbed on. A blowpipe should be used, but in the case of small work a soldering iron may be employed.

Highest Commercial Speeds

Q. We are interested in obtaining for advertising purposes information on the highest rotative speed obtained commercially on a machine that operates with ball bearings. We have heard of grinders running at 30,000 r.p.m. Can you tell us of any machine that has a higher speed?

A. We believe that the highest commercial speeds are obtained on small internal grinders. There are several manufacturers of these high-speed grinders. One company, which regularly makes grinding spindles to run at 25,000 r.p.m., also offers a special air turbine driven spindle to operate at 65,000 r.p.m. This grinding spindle is intended for internal grinding in holes as small as $\frac{3}{32}$ in. Another maker has experimented with speeds up to 120,000 r.p.m., but ordinarily recommends a maximum spindle speed of 35,000 r.p.m. because of the short life of the ball bearings at the higher speeds.

While these rotative speeds seem high, they give relatively low peripheral speeds on small grinding wheels. A ¼-in. wheel operating at 35,000 r.p.m., for example, has a peripheral speed of only 2,291 ft. per min. compared with the average grinding speed of 5,000 ft. per min. It is probable, therefore, that makers of grinders and of ball bearings will continue to experiment with the idea of attaining higher speeds for grinding.

Technical Abstracts

Interpretation of Macrostructure of Cast Metals

The relative proportions of columnar (laterally restrained and growing toward the mold center) and "free" crystals in a steel ingot give definite indications regarding the initial temperature of the metal and the rate of cooling. The most desirable macrostructure is one consisting entirely of equiaxed (free) crystals since interdentritic cavities due to shrinkage are less liable to occur. In copper, however, the occurrence of columnar crystals is not a source of weakness. In steel these interdentritic cavities weld during working, but in brass and other non-ferrous alloys it is doubtful whether the influence of ingot cavities can be eliminated once they are formed. Sand castings of non-ferrous alloys, which consist mainly of equiaxed crystals, are in general weaker than chill castings, where any cavities are localized. Hence columnar crystalization need not be feared in all alloys.—R. Genders in *Engineering*, July 16, 1926, p. 88.

Cutting Transportation Costs

The most significant business waste in the United States today is the cost of distribution of our products. We have railroads, water ways, and motor highways, but no concerns with legal power to transport our goods to their destination by the best and cheapest method. We have no transportation company systems.

One of the new developments has been the unit container, which fits on a truck or in a freight car and goes the whole trip. It has solved the pilferage and damage questions and has reduced transportation costs. But statistics show that more than half of transportation cost lies with terminal and cartage charges. The shippers of the country should co-operate directly with the railroads. Better packing and loading methods, closer co-operation with carriers in the use of cars, informal adjustments of difficulties, and intimate studies of products to be moved in a region are making for increased efficiency. Manufacturers must insist that their traffic managers look on their jobs with a national viewpoint. In transportation it pays the executive to know what is going on outside his own business.—John A. Piquet, in *Industrial Management*, July, 1926, p. 46.

Shop Records That Increase Efficiency

It is essential in conducting any business to have accurate cost figures available at all times, but in too many factories not a single report is ever submitted to the factory organization. Under such circumstances there is no incentive for the factory organization to improve conditions.

One of the purposes of factory records is to furnish danger signals. When the production per man-hour is low, or when too much material is being used in proportion to the product, the facts should immediately be apparent from the records. Records in the hands of an intelligent foreman are the same as tools to an intelligent worker; by their use he can increase his output and reduce his costs.

Records are valuable to a superintendent, as they enable him to keep in touch with all departments without personally supervising the activities of each. The intelligent foreman welcomes cost records, as they provide him with a criterion by which to gage his own efforts. Without them he may think the department is doing well, but when comparative figures are in his hand he knows definitely just how well he is doing.

It is a good scheme to check up on records from time to time in order to see that all are being used. There are men who spend their whole lives in compiling figures that are never looked at. Hundreds of records may be kept that are of no value. On the other hand, hundreds of records might be kept that would tend to increase efficiency. The test is: What does the record accomplish in the way of cost reduction.—J. Seton Gray in *Machinery*, July, 1926, p. 857.

Bright Annealing by Gas

For the annealing of non-ferrous materials such as nickel-silver alloy, copper, brass and aluminum, Manning, Bowman & Co., have installed specially designed furnaces.

In the low-pressure combustion system such as is used in this plant, air is boosted to one or two pounds pressure and gas is entrained through the same inseparators, in the correct proportion. This air-gas ratio is constant, regardless of the manipulation of the single valve to the burners.

The flames are played upon or through beds of pocketed refractory material which becomes incandescent, increasing the rate of combustion and promoting radiation. The furnaces leave no scale on the work so that pickling is unnecessary, and the work is bright annealed. The parts are pushed in at one end of the furnace by a hydraulic jack and allowed to remain as long as necessary. They are forced out at the other end by the same jack and dropped into a tank of water where they are quenched.—J. B. Nealey in *Industrial Gas*, July, 1926, p. 15.

Industrial Posture and Sitting

In industrial work, good posture is not assured by having a good chair, but the worker, the chair, the bench, and the material placement should be correlated properly. The worker should not sit on the edge of a chair to reach a foot pedal, nor sit improperly in a chair in order to reach up for material.

The most satisfactory industrial chair is one having wood in its construction. A small bar that fits into the small of the worker's back gives the necessary support without interfering with arm movements. The seating area does not have to be large if the worker sits far back. The edges of the chair should not be sharp nor long so as to interfere with leg action. The chair should be adjustable as to height of seat and of the back bar that fits the small of the worker's back.—Nellie Schwartz in *Mechanical Engineering*, August, 1926, p. 814.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Is the Foreman a Manager?

IS THE foreman a manager? Or are we "propaganding" when we talk of his managerial functions?

Representatives of some large concerns at a recent conference felt that the foreman is never a manager, but only a sort of human schedule board or glorified clerk, to see that the orders of the planning department are carried out. If this is true, why not let a clerk do the job? Why waste a good foreman's skill and experience when only a clerk is needed?

Those who hold the clerk viewpoint consider only the times when everything runs smoothly in the shop. But let a lot of bad castings come in, a lot of cutters be below standard, a few machines break down, a serious accident happen, and what becomes of production and morale with only the clerk on the job?

Any general manager can make a set of rules that will take care of the general run of business. If that were all he could play golf and let his secretary run the plant. But he knows that conditions will arise that no rules can cover, when some of them must be temporarily swept aside to prevent a jam. The ability to do so with fair judgment is management.

The foreman occasionally has the same condition to meet. Unless he does assume "managerial functions" production falters or stops. If he breaks the routine and wins, we talk of his initiative and advance him. If he guesses wrong—but he averages about as good a percentage as his superiors. And if such a foreman isn't a manager —who is?

Why America is Prosperous

IN GERMANY there is a conviction among the working people that Americans are prosperous "because they won the war." This statement is taken from a prize-winning essay written by a German mechanic employed by the Ford Motor Company. The subject of the essay is "What I have learned from my work."

This man goes on to tell how he worked with a house-wiring gang in Germany in 1921. One job was to cut a hole for the main cable through a four-foot cellar wall of masonry. It took four of them three and a half days to get through the wall. Their tools were a plain chisel and a hammer. When he asked the foreman why they did not have better tools the reply was to the effect that holes had always been drilled that way and therefore the tools they had were good enough.

Being a man of some ambition, he went to America to try to better his condition. He got a job with Ford. After five years of work with the efficient Ford organization he has this to say: "So I have learned from my work that the American people are prosperous and receive 'high' wages, not because they won the war, but because they are always looking for better and faster methods to do their work instead of pinning their hopes for a better living on political strifes and machinations."

Where Economies Can be Effected

ARE high labor or high material costs more desirable? In other words, is it better to have a business in which labor is ten per cent of your total or one where labor is a much greater percentage of the total cost?

In most cases it seems best to have the larger percentage of labor, as that apparently affords the greatest opportunity for saving. Not by the unwise and unsound method of cutting wages and thereby reducing purchasing power in the community, but by making labor more productive.

Competitive manufacturers, as a rule, pay about the same for material so that little is to be gained in purchasing. But in the most efficient utilization of labor, and this should include supervision or management, there are many opportunities, not the least of which is the use of better and more economical equipment.

Savings by Decreasing Work in Process

MODERN manufacturing is a complicated process. In order to keep the desired volume of finished work coming out, it is necessary to have many times the number of parts in process, in the works. And the longer it takes to get a lot of parts through the works, the greater the capital tied up in what we call "inventory."

Anything that will shorten the time of the work in process, and insure a steady supply of parts for assembly reduces the capital tied up in material. Either an increased rate of production or a continuous flow of work aid in reducing this expense.

Improved machine equipment and improved methods that shorten the time of work in process should be credited with this saving, as well as with the savings due to a decrease in actual production costs.

Shop Equipment News

American Traversing Bases for Radial Drills

The American Tool Works Co., Cincinnati, Ohio, is marketing two types of traversing bases for radial drills, shown in Figs. 1 and 2 respectively. In each case the standard triple-purpose American radial drill is used, and consequently it is claimed that a wide variety of work can be handled, although the traversing feature was developed especially for use by boiler manufacturers and also in railroad boiler shops. For such work the boiler plates can be stacked and all of the drilling completed without resetting the work. The idea is to bring the drill to the work rather than the reverse.

These traversing radial drills can be removed at any time from their traversing bases and placed on stationary floor plates, thus making standard radial drills out of them. All of the features of the standard machine are retained, including the patented internal gear drive, the ball-bearing tapping attachment that runs in oil, the automatic depth gage, the quadruple geared head and improved feeding mechanism, and other minor features. The machine is built with 4-, 5-, 6-, 7-, 8- and 9-ft. arms, covering a wide range of work.

Both types of traversing drill can be furnished with either a pneumatic- or an electric-actuated column clamp controlled from the head. When direct current is available a 3-to-1 variable-speed motor is mounted on the arm, and is controlled from the head so that the operator can change speeds from his working position. With this type of drive the machine can operate in a complete circle, and hence work can be set up on each side of the bed plate or track that the unit moves on.

The traversing base shown in Fig. 1 travels along a standard U. S. railroad-gage track either by power, subject to control from the operating position, or by hand. The base is mounted on four steel wheels, which in turn are mounted on roller bearings. When the unit is positioned for drilling the base is clamped to the track at four corners by means of a single lever at the front of the base. The lever is within easy reach of the operator. Power movement along the track is obtained through a 2-hp. motor mounted on the base and controlled by means of a push button.

The type of traversing drill shown in Fig. 2 is also used for boiler plate work, and in addition it can be adapted to drilling, tapping, reaming, boring or stud-driving in large castings that require crane service for moving. With this type of mounting the drill traverses along a heavy and substantial bedplate. One or more drilling units can be mounted on a single long bed, depending upon the nature of the work. A rack is provided on the bed and by means of a pinion the drill is traversed in either direction by power supplied through a motor mounted on the base and controlled from the operating position through a push button. The drilling machine proper is standard equipment.

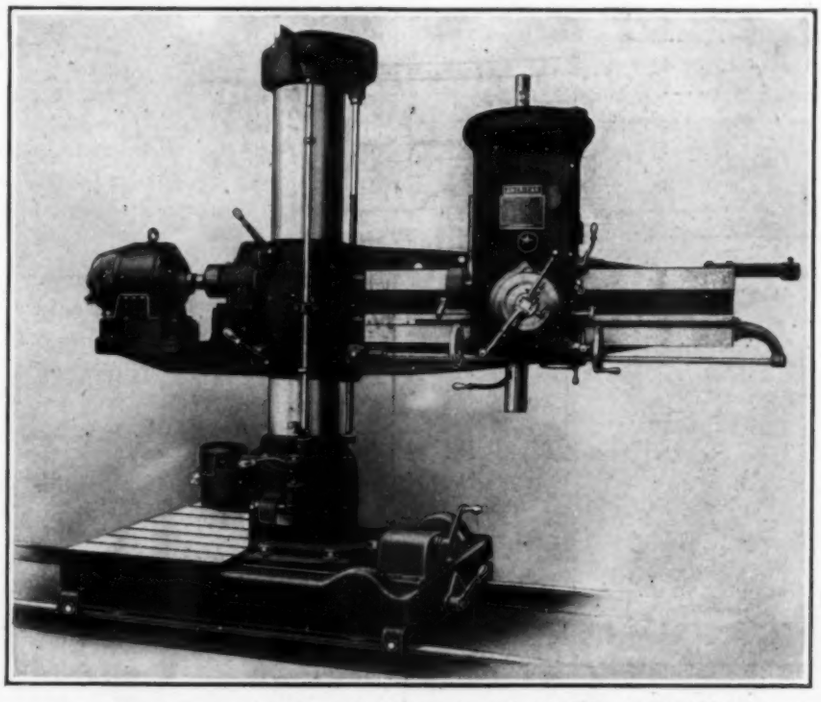


Fig. 1—American Traversing Base for Radial Drills, Rail Type

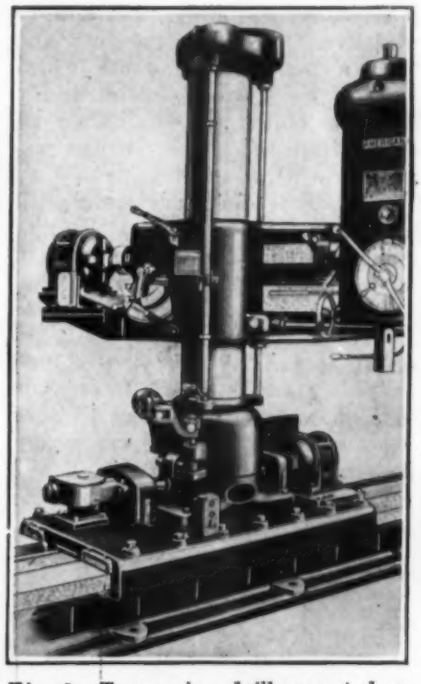


Fig. 2—Traversing drill mounted on long bedplate

Shop Equipment News

Hurlbut-Rogers Cutting-Off Machine 10-In. Capacity

The Hurlbut-Rogers Machinery Co., Nashua, New Hampshire, has placed on the market a large size cutting-off machine, capable of cutting off stock up to 10 in. in diameter.

The machine is driven by a 7½-hp. multi-speed motor. The motor is mounted on a pedestal extending from the rear of the machine base, and it drives through a silent chain and speed reducing gears. A friction clutch is incorporated in the drive, by means of which the spindle may be started and stopped independently of the motor.

A Foster-Barker wrenchless chuck holds all sizes of stock up to 8 in. in diameter. For sizes between 8 and 10 in. a special Skinner chuck is provided. The steadying chuck at the rear end of the spindle handles all sizes within the capacity of the machine

Sight-feed lubricators are applied to all important bearings. The machine is fitted with a geared pump to deliver oil or cutting compound to the tools. The oil reservoir is made in two parts; the upper part has a screen bottom and it is made to slide on rollers in the main reservoir so that it may be withdrawn easily whenever necessary to remove the accumulated chips.

The machine is equipped with the usual double tool slide, operated by a right-and-left-hand screw. A three-step cone on the feed shaft provides for different rates of power feed. The handles of the clutch and motor control box are mounted on the front of the machine within easy reach of the operator.

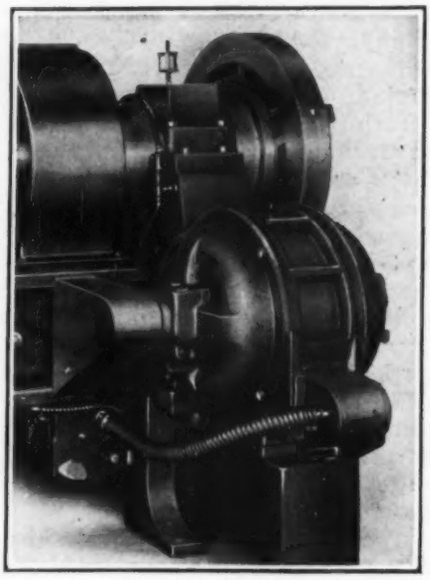


Fig. 2—Rear view of machine

The machine, including the driving motor, occupies a floor space of 7x8 ft. and weighs 7,500 pounds.

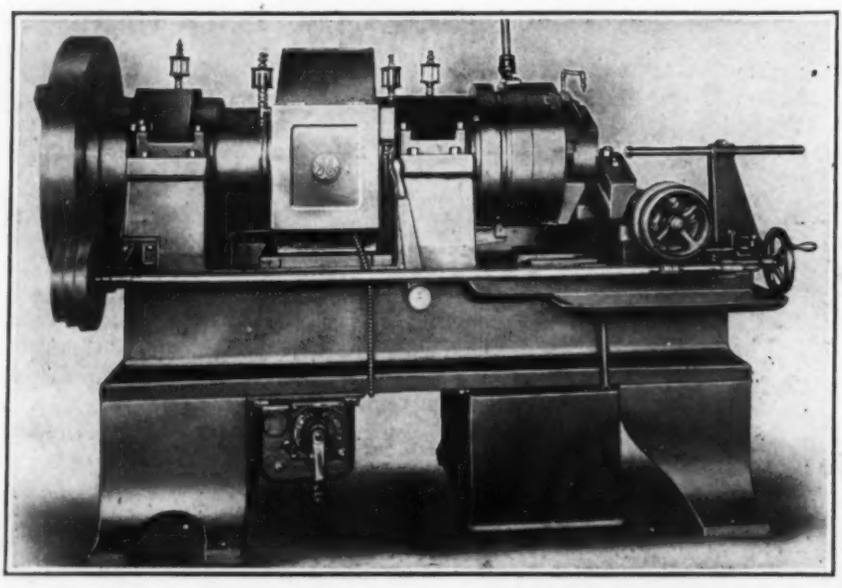


Fig. 1—Hurlbut-Rogers Cutting-Off Machine, 10-In.

Kent-Owens Hand Milling Machine, Heavy-Duty, No. 2

The No. 2 heavy-duty hand milling machine, illustrated, has been placed on the market by the Kent-Owens Machine Co., Toledo, Ohio. The machine is intended to enlarge the size and scope of work that could be formerly done on this manufacturer's No. 1 machine.

The frame of the machine is rigid, since the absence of openings for speed and feed change gears permit a liberal use of ribbing. A large coolant reservoir is cast directly in the base. It has a capacity for four gallons. The base is troughed for catching chips and oil. The knee, cross-slide, and table have deep sections and large surface bearings to insure accuracy, rigidity, and long life.

The working surface of the table is 28 in. long by 7 in. wide with two

Kent-Owens Hand Milling Machine, Heavy Duty, No. 2

⅝-in. T-slots. The overall dimensions of the table are 32x11 in. and an oil channel is provided completely around the working surface.

The spindle is mounted on adjustable taper roller bearings and can be operated up to 2,000 r.p.m. maximum speed. Hence the high speeds necessary for small diameter cutters and for properly milling brass, aluminum, and other soft materials are available. The spindle pulley is of the balanced flywheel type to elimi-

Shop Equipment News

nate chatter. The standard size is 22 in. in diameter by 4¼ in. face. Special pulleys can be provided for specific jobs or for high spindle speeds.

Long adjustable hand levers are provided and are conveniently located for the head and table feeds. The head may be moved 6½ in. vertically and the table 4¼ in. longitudinally by means of these levers. The lever feed movements are adjusted by means of positive stops. The maximum distance from the spindle to the table is 17½ in. The table can be fed 22 in. and the cross slide 7 in. by means of a crank. Graduated dials on the cross slide and elevating feed permit rapid and accurate adjustment of the work.

It is claimed that the hand feed permits continual adjustment of the feed to suit the cross section of the cut. The machine is especially adapted to light- and medium-sized milling jobs.

Drive is either direct by motor or from a countershaft. A 3- to 5-hp. motor is recommended. When driven from a countershaft a Hyatt roller-bearing countershaft is provided. The machine occupies an overall floor space of 38x60 in. The net weight is 2,100, lb., gross weight 2,580 pounds.

Flather Monitor Lathes

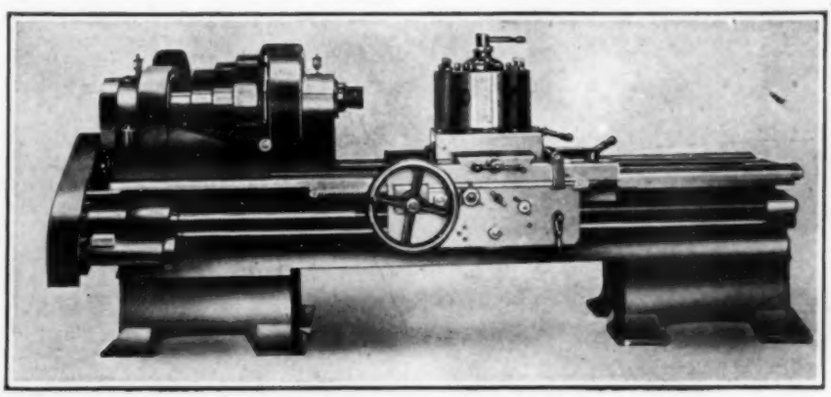
Flather & Co. Inc., Nashua, New Hampshire, are putting out a line of monitor lathes, as shown in the illustration, in all sizes from 16- to 36-in. swing. The headstock has all-steel gears. The backgears are permanently engaged, and the spindle is "open belt" or "back geared" in accordance with the position of the clutch lever.

The wide cross-slide is fitted with a six-position turret that is indexed by hand and locked automatically in each position. This turret revolves on roller bearings, but is so made that when held by the clamping lever in any position the weight and thrust is borne by fixed bearing surfaces.

A rapid-power traverse is provided for the carriage, operated by the handwheel on the apron. When this wheel is pulled out to a stop the pinion is disengaged from the rack and the power traverse can be operated. With the wheel pushed back to re-engage the pinion the power traverse is disengaged and the carriage may be traversed by hand. This construction constitutes a safety feature, in that the power movement cannot be accidently engaged with the handwheel is position to revolve.

The power traverse is accomplished by a right-and-left-hand screw of quick pitch, located behind the lathe bed and engaged by nuts that are under control of the handwheel when the latter is pulled out. With the wheel in this position a slight forward movement of the wheel causes the carriage to traverse rapidly toward the headstock. The nut is disengaged and the movement is stopped when the handwheel is released. Conversely, a slight turn backward of the handwheel traverses the carriage away from the headstock. There is an automatic knock-out at the rear end of the bed, so that the carriage cannot be made to overrun and thus cause damage.

The remaining features of the machine are those of the standard Flather lathe of corresponding size. Change gears or geared feed-box may be furnished as desired.

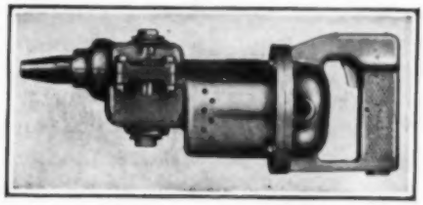


Flather Monitor Lathe

Ajax Portable Electric Hammer, Type B-2

The Ajax Electrical Hammer Corporation, 117 West 63rd Street, New York, N. Y., is marketing the type B-2 electric hammer illustrated. The hammer was designed primarily for drilling and chipping materials, such as brick, marble, cement, and metals, and it has proven adaptable to other fields as well. A chuck that holds standard tapered-shank drill points fits directly in the hammer, which is provided with a handle for rotating the drill while in operation.

The hammer consists of only three moving units: the motor, the crank shaft assembly, and the plunger, all of which are housed in an aluminum frame. The crank is driven at right angles to the motor by means of a 4.75-to-1 bevel gear reduction. A hardened roller mounted upon a hardened steel pin extends from the face of one end of the crankshaft and engages a curved slot cut in the face of the plunger and imparts to it a variable-speed reciprocating movement. Approximately two-thirds of the revolution of the pin is consumed in lifting the plunger and one-third to throwing it with accelerated velocity against the tool head. The plunger is thrown and not forced against the tool head so that no shock is transmitted directly to the gears or to the motor With this construction it is claimed that it is impossible to overload or to stall the motor.



Ajax Portable Electric Hammer, Type B-2

The hammer delivers approximately 2,400 blows per minute independent of the size of the drill or chisel being used. The drilling speed of this hammer with a 1-in. drill in hard concrete is about 2 in. per min-

Shop Equipment News

ute. For the smallest size hole of ⅛ in. in diameter the speed is much greater. By employing a chisel, castings can be chipped readily.

The hammer is driven by a universal motor and can be operated direct from any electric lighting circuit. It consumes 220 watts. It weighs approximately 10 lb. and hence is readily portable. Control is by means of a trigger switch located in the handle of the tool.

Mitchell Motor-Driven Grinder, Two-Speed

A two-speed motor-driven grinder has been placed on the market by the Mitchell Engineering Co., Springfield, Ohio. In Fig. 1 a general view of the machine is shown, while in Fig. 2 the motor drive is featured.

The motor is mounted on the rear of the machine on a slidable base for vertical adjustment in order to keep the belt taut. It is the ball bearing type, fully inclosed and ventilated. A fan is mounted on one side of the rotor for drawing in fresh air through oval openings, and forcing the air through the windings and discharging it from the other opening. The motor is controlled with a magnetic switch, and a start-and-stop push button control.

The grinding spindle is provided with a two-step cone pulley that can be slid along the shaft so as to line up one of the steps with the motor pulley. With this construction two wheel speeds are available, so that the proper peripheral speed of the wheel can be obtained after the wheel has worn down.

The wheel load is carried on four heavy-duty ball bearings that are mounted in cast iron housings that have spherical seats in the pedestal. Two ball bearings are mounted in each housing, and the ball and socket arrangement assures alignment of the spindle and equal distribution of the load on all bearings. This construction is also said to facilitate dismounting and re-assembling the spindle and bearing units. The ball bearings are fully inclosed against the entrance of dirt and abrasive matter.

The grinding wheels are provided with suitable cast iron guards and adjustable tool rests. The machines are built in several sizes to accommodate wheels 10 to 24 in. in diam.

Any standard motor can be used where preferred.

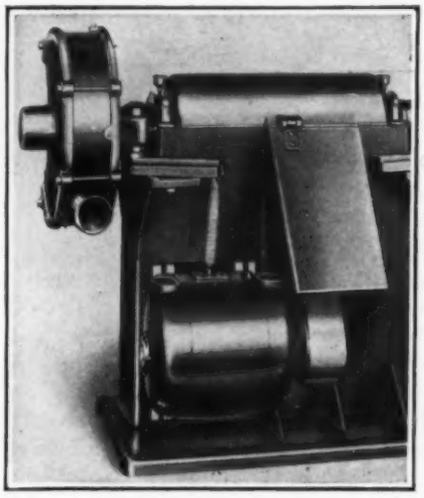


Fig. 2—Driving Motor

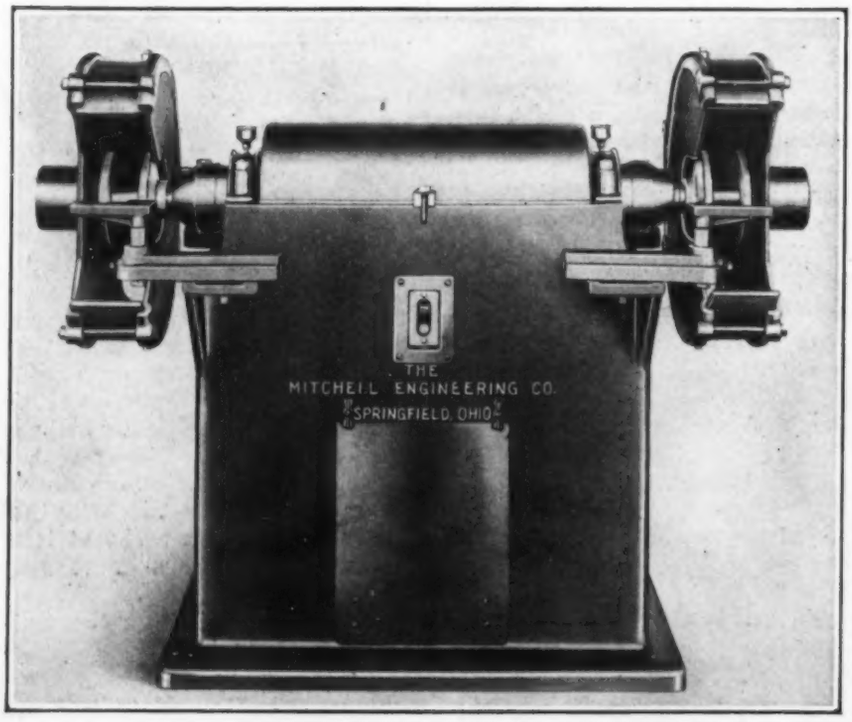


Fig. 1—Mitchell Motor-Driven Grinder, Two-Speed

"M. C. E." Centrifugal Babbitting Machine

The centrifugal babbitting machine illustrated in Fig. 1, is being marketed by the Manufacturers' Consulting Engineers, 487 South Salina Street, Syracuse, N. Y. The motor drive is shown in Fig. 2. The machine is particularly designed for babbitting automotive connecting-rod bearings.

A 1-hp. ball-bearing motor drives the machine by means of a belt. The motor is bolted to the under side of the table and is suspended in the pedestal of the machine. As can be seen in Fig. 2, the table is hinged for ready inspection of the motor and adjustment of the idler tightener pulley.

The motor drives a ball-bearing clutch pulley. The clutch is free to slide on the spindle and is controlled by a hand lever so as to engage either a cast-iron stationary brake or a cast-iron rotating clutch member that is keyed to the spindle. The engaging member is made of a special alloy bronze.

The spindle is also mounted upon ball bearings, and on the front end of the spindle is placed an aluminum face plate, which carries the work-holding fixture. The fixture consists of two hardened, ground and polished steel plates. One is fastened directly to the face plate and the other is mounted on three spring plungers. When the piece is loaded in the machine, the outer plate is moved out-

Shop Equipment News

ward by means of a toggle and lever. When the lever is released the work is clamped between the two plates by means of the spring pressure. The same movement automatically centers the piece and in the case of a con-

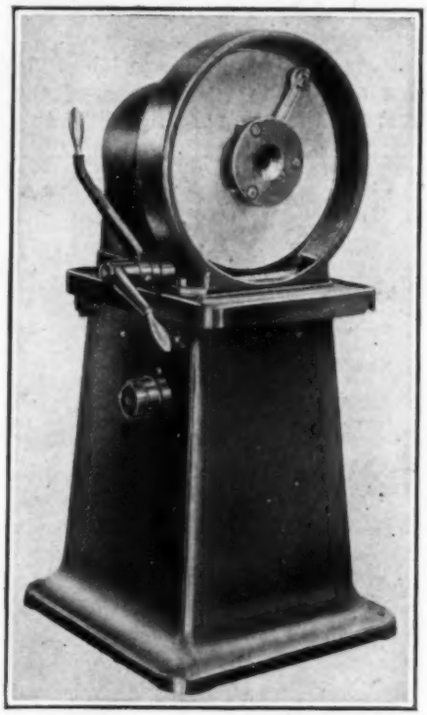


Fig. 1—"M. C. E." Centrifugal Babbitting Machine

necting rod the wrist pin hole engages a pin in the face plate that prevents rotation of the connecting rod with respect to the plate.

The clutch is 10 in. in diameter and the engaging pressure whether for braking or driving is obtained by means of springs. This spring pressure is light so as to prevent undue wear, but at the same time quick starting and stopping is obtained.

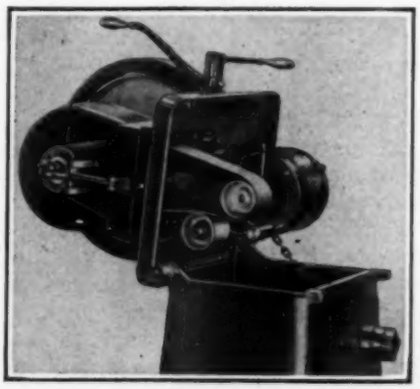


Fig. 2—The driving motor

In operation the piece to be babbitted is first cleaned and tinned and immediately placed in the fixture before it can cool. The clutch is then engaged and the face plate is rotated. A measured quantity of babbitt metal is then poured through the center hole in the outer plate of the fixture and thus into the bearing. Centrifugal force throws the metal against the inner wall of the bearing where it solidifies. This method of depositing molten babbitt metal against the inner wall of the bearing is said to prevent the occurrence of blow holes or air pockets. It is also claimed that all impurities, which are lighter than the metal itself, collect on the inner surface where they are removed in the first boring operation. The production of this machine is limited by the operator and the time required to cool. A production of seventy-five pieces per hour is claimed on a connecting rod having a 2½-in. bore and being 1⅞ in. long.

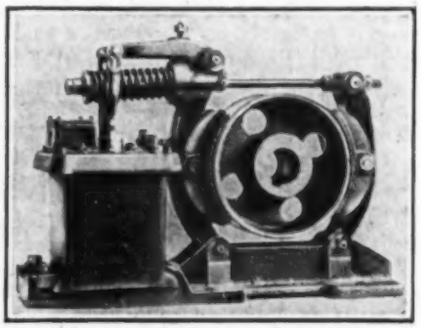
The capacity of the machine is a 12½-in. connecting rod. The machine occupies a floor space of 30x36 in. The net weight is approximately 1,000 pounds.

Westinghouse Magnetic Brake

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., are marketing types DI and AI magnetic brakes for use with both direct and alternating current. The AI brake is illustrated.

The brake has unusually small dimensions. The small diameter of the brake wheel is said to require less power to operate, and less time for stopping and starting. The braking mechanism is spring set, and is easily adjusted. A manual release enables the motor to be operated without the brake during inspection or test. The brake shoes are self-aligning so as to prevent lateral strain upon the motor shaft.

The magnet proper is incased in a weatherproof cast-steel housing. Ventilation is provided by hooded openings in the cover and cored holes in the base of the magnet housing. The same equipment may be used for



Westinghouse AI Magnetic Brake

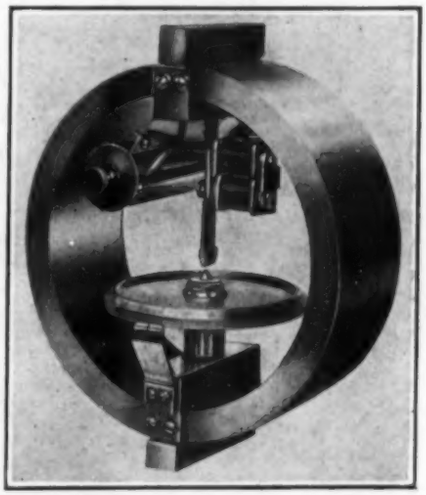
both alternating and direct-current work by merely interchanging the magnet. The complete magnet can be removed from the brake by taking out one pivot pin and loosening two bolts in a tapered block.

The direct-current brakes can be constructed for marine service, with waterproof inclosures and protection against corrosion.

Olsen Brinell Proving Ring

The Tinius Olsen Testing Machine Co., 500 North 12th Street, Philadelphia, Pa., is marketing the Brinell proving ring, illustrated. Primarily the ring is for use in verifying Brinell hardness testers, but with some slight modifications it may also be used for verifying heavier-capacity testing machines, as desired, up to the capacity of the ring.

The ring is provided with an electrically operated vibrating reed. The ring is placed in the testing machine and the reed is started in vibration. The standard Brinell test load is then



Olsen Brinell Proving Ring

Shop Equipment News

placed upon the ring and its deflection is measured by varying the position of a graduated disk until the point it carries interferes with the moton of the reed. By varying the size of the reed other loads than the Brinell load can be verified up to the ring capacity.

Kingsbury Drilling and Tapping Machine Type EB

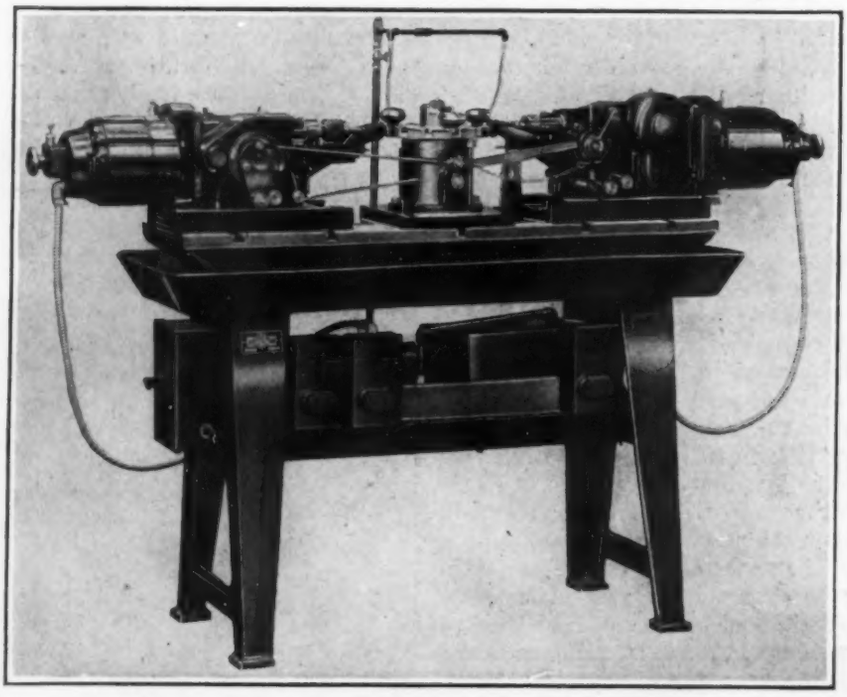
The type EB universal double-end drilling and tapping machine illustrated is being built by the Kingsbury Machine Co., Keene, New Hampshire. The unit consists of this company's No. 18 motor-driven drilling head and its No. 14 tapping head with built-in reversing clutch, mounted upon a single base with its No. 75 automatic indexing fixture between the tools. As pictured the machine is set up to drill and tap the holes in the shanks of door knobs, but it is applicable also to any small drilling and tapping work of a like nature.

In these heads the motors drive the spindles through suitable speed reducing gears, while the feed motion is derived from the spindles through a worm and wormwheel to a cam, one revolution of which completes a cycle. A friction device permits the rate of feed to be adjusted to suit the size of drill and nature of the material being drilled, and also serves as a safety device to prevent drill breakage. The feed of the tapping head merely brings the tap forward to enter the work, after which the rate of advance is governed by the lead of the tap.

The machine is automatic in its action; the operator places the workpieces in the holding fixtures as each is presented to the loading position, and unloads the finished pieces. A piece is completed at each cycle of the machine after the turret is filled. There are twelve indexing positions.

The machine is ready to run in any position where it can be connected to a source of electric supply. The motor controls are located on a shelf below the chip pan within easy reach of the operator. The machine is equipped with a motor-driven circulating pump and reservoir to supply oil or cutting compound to the tools.

The floor space occupied by the machine is approximately 2½x7 feet.

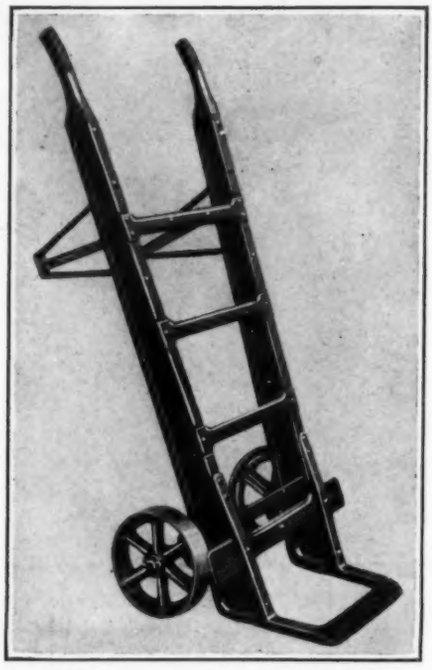


Kingsbury Drilling and Tapping Machine, Type EB

"American" Steel Hand Truck

The American Pulley Co., Philadelphia, Pa., is marketing the steel hand truck illustrated. The truck is made of pressed and forged steel parts and is said to be strong and serviceable.

It is claimed that special study was devoted to the balance of the unit and the true-running of the two wheels. Parts injured in an accident can be readily replaced. The truck is light and hence can be handled easily. It is made in several models and in a range of sizes.



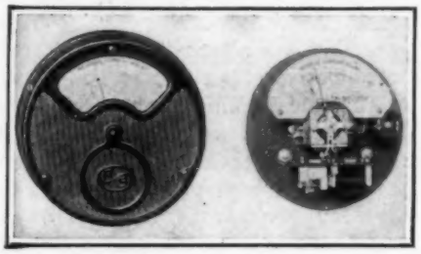
"American" Steel Hand Truck

Roller-Smith D.C. Relay Type SR

The type SR d.c. relay illustrated has been placed upon the market by the Roller-Smith Co., 233 Broadway, New York, N. Y. With a few modifications in each case, the relay can be made to serve as a reverse-current relay, an overload, unlerload or "closed-circuit" underload, overvoltage, or under-voltage relay. The scales are longer and the torque has been increased over former models and the accuracy is said to be greater. The instrument is used in connection with a circuit breaker.

The instrument mechanism has

Shop Equipment News



Roller-Smith D.C. Relay, Type SR

attached to its pointer a platinum spring contact that contacts with a similar piece carried by an adjustable pilot needle. The latter is set by means of a slotted head button projecting from the front of the case. The circuit established by the buttons energizes the electromagnet that controls the relay switch and in turn the circuit breaker.

The overload relay may be used to operate a signal and may also be used in connection with an under-voltage circuit breaker. The over- and under-voltage relays have a voltmeter mechanism and are connected across the line, while the over- and under-load relays function with a change in current.

"Schraner" Crankshaft Lapping Machine

The crankshaft lapping machine, illustrated, is manufactured by A. P. Schraner & Co., and is being marketed by Kenneth Ingersoll, Book Building, Detroit, Mich. Fig. 1 shows a general view of the machine, while further details of the lapping mechanism are given in Fig. 2. The machine is intended for use on automotive crankshafts.

The bed of the machine contains the driving motor, a gear box for transmitting power to the headstock and to the table oscillating mechanism, a kerosene tank and pump, and a lubricating oil pump. The table itself is mounted on ways on the bed with an eccentric mechanism that oscillates the table back and forth the required amount. The head and tailstock for holding and rotating the crankshaft are bolted to the oscillating table.

The upright housing at the rear of the machine is provided with ways for carrying the tool saddle. The heads for lapping the line bearings are held in a fixed position with relation to the lower cross-rod.

The heads for lapping the crank pin bearings are only guided against sidewise motion in relation to the lower cross rod. These heads are guided between guide arms, which are held in a fixed position on the cross rod. The upper part of the crank pin bearing heads carry vertical shafts that pass through fittings on the upper cross shaft. These fittings are held against sidewise motion but are free to turn on the upper cross shaft.

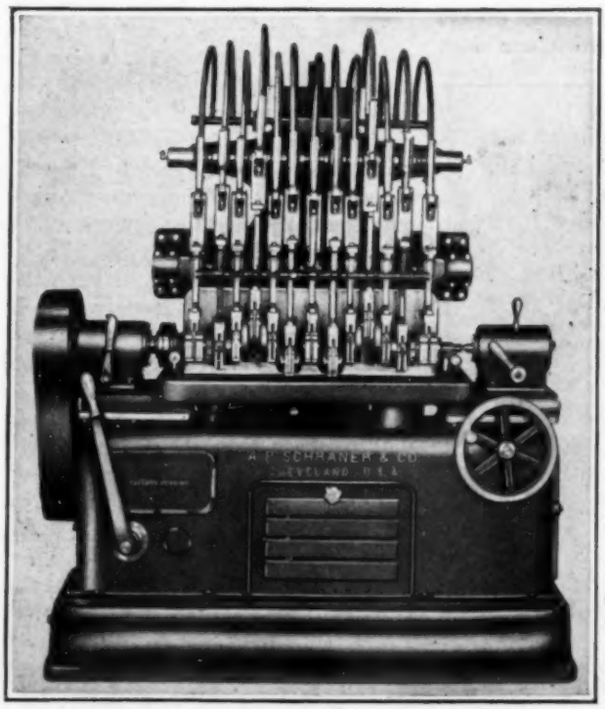


Fig. 1—"Schraner" Crankshaft Lapping Machine

The guide arms for the crankpin bearing heads can be clamped against the head in a fixed position when the tools are open and the saddle is raised. By this means the heads can be kept in proper position with relation to each other, and quick loading is facilitated.

The tool blocks consist of jaws that are opened and closed by means of individual levers. Each jaw holds two stones, there being four stones clamped around each bearing. Each stone is ½-in. square and approximately ⅛-in. shorter than the bearing be lapped. The stones are of a fine grade and act both as a remover of stock and as a polishing agent. The stones are held against the work by a constant spring pressure. The tool jaws are opened by means of cam levers against the spring pressure. The same levers also control the flow of kerosene, which is delivered through the heads directly to the work and is automatically cut off as each pair of tool jaws is opened.

When the jaws are open and the saddle raised the operator places the crankshaft on a loading device and moves it between the head and the tailstock. The crankshaft is picked up by locking the head and tailstock levers, and the saddle is lowered to a positive stop. The clamping levers are then released. The headstock rotates the work at about 150 r.p.m. and the table oscillates back and forth. At the end of a predetermined time the machine stops.

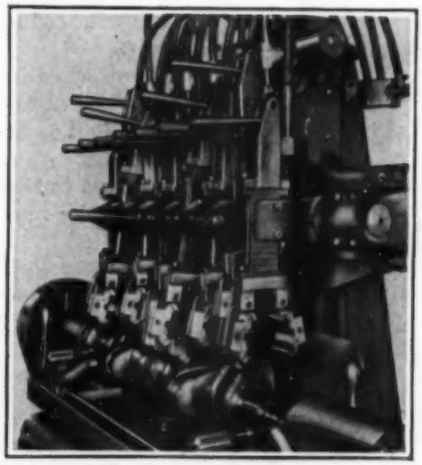


Fig. 2—Arrangement of the lapping blocks

A time dial is provided that can be set for any length of time found to be necessary to produce the required results. There is also an adjusting nut for increasing slightly the amount of table oscillation so as to compensate for the wear of the stones on the ends. Means are provided for taking up wear in other places as well.

Shop Equipment News

It is claimed that all the metal removed seems to be taken off in about the first 30 seconds, and thereafter the operation is one of polishing. It is said that satisfactory results can be obtained in two minutes floor to floor time. This machine will not correct bad grinding errors, but it is claimed that it will improve out-of-round and taper conditions quite noticeably. It will also cut down the high spots, remove grinding marks, and give a very smooth surface with a high luster.

In order to correct the lapping stones a stone dresser is provided. It consists of an arbor, the same length as the crankshaft, and is fitted with enough small emery wheels to duplicate the various bearings.

Economy Automatic Bolt-Pointing and Threading Machine, Improved

The Economy Engineering Co., Willoughby, Ohio, has redesigned and improved its automatic bolt-pointing and threading machine. Another size has been added to the line, making a total of three sizes.

The machine can now be supplied, if desired, with a right-angle drive with a tight and loose pulley. The pulley shaft and loose pulley itself are mounted on Timken roller bearings. With the right-angle drive the machine is driven directly from the lineshaft without the use of a countershaft.

A bolt bucket has been attached to the side of the base. The work drops into a pan in the bucket, and oil from the bolts drains through holes in the bottom of the pan and returns to the reservoir in the bottom of the machine. The bucket is operated by a lever and when filled is dumped into a wheelbarrow. Positive drive has been provided for the hopper operating crank with a relief device between the crank and the hopper. It is claimed that this construction increases the efficiency of the unit because if the hopper sticks the machine will still keep in operation until all the bolts are fed out of the chute. The hopper itself has been increased in size.

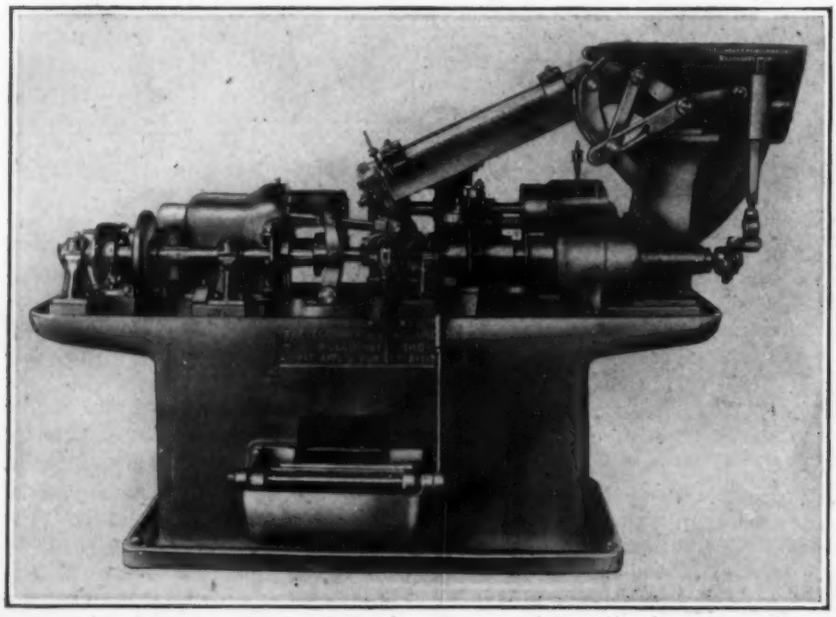
The blanks pass from the hopper through a chute and are transferred mechanically to the chuck. The turret has three stations; loading, pointing, and threading. After chucking, the turret is indexed to the pointing station, then to the threading station, and finally returns to the loading position, where the finished bolt is dropped from the chuck and a new blank is substituted.

The feed hopper delivers the blanks to the feed chute by means of the usual double blade, which oscillates vertically. A cam-operated escapement or bolt separator having two rods that are alternately thrust forward between the blanks is located on the chute. This mechanism holds back the blanks as well as allowing the transfer mechanism to deliver the bottom blank to the chuck. The transfer mechanism consists of a cam-operated lever carrying a pair of spring fingers that grip the blank and deliver it between the chuck jaws. The chuck is also operated by means of a cam-actuated toggle mechanism that pushes a rod forward to open the jaws and withdraws the rod to close the jaws on the blank.

After a blank is placed in the chuck, the turret-locking bolt is withdrawn and a cam roller actuates a Geneva movement, indexing the turret one-third of a revolution, and bringing the blank in place to be operated upon by the pointing head. The blank just pointed is then in a position to be threaded by the die head, and the blank just threaded is carried to the loading position and dropped from the chuck.

The pointing head is spring actuated and when the operation is completed, the head is returned against the tension of the spring. Two separate cams produce the four movements through which the die head passes in the threading operation. One closes the die after it has backed off a bolt and leads it forward to the next blank. The other cam opens the die after threading and returns it to the starting point.

Change gears are provided to permit the machine to handle different classes of work. The ratio between cam shaft rotation and work speed may be varied to obtain the highest efficiency in threading bolts with different numbers of threads per inch. The lead cams, also, can be changed to suit the work. The No. 1 machine threads bolts from $\frac{1}{16}$ to $\frac{3}{4}$ in. in diameter and from 1 to 4 in. in length. The No. 2 machine threads bolts from $\frac{1}{4}$ to $\frac{7}{8}$ in. in diameter and from 1 to $4\frac{1}{2}$ in. in length. The No. 3 machine threads bolts $\frac{3}{8}$ to $\frac{7}{8}$ in. in diameter and from $1\frac{1}{4}$ to $5\frac{1}{2}$ in. long. The output of the three machines for threads 1 in. long are as follows: 1,200 $\frac{3}{8}$-in. bolts per hour on No. 1 machine; 1,000 $\frac{1}{2}$-in. bolts per hour on the No. 2 machine; and 750 $\frac{7}{8}$-in. bolts per hour on the No. 3 machine.



Economy Automatic Bolt Pointing and Threading Machine

News of the Week

Coal Shortage and Few Domestic Orders Affect British Machinery Industry

Railway and automobile shops buying some equipment

By Our London Correspondent

The whole economic position in Great Britain is overshadowed by the continued dispute in the coal mining industry. This is obvious to everyone, or perhaps it would be better to say to nearly everyone, for in some of the Southern districts, less concerned with manufacturing, the conditions of life have not greatly changed. The farther north one goes, however, the more clearly will be seen signs that enterprize has been minimized and even routine operation checked.

Great Britain has become a coal-importing country, and it is by means of these imports that the required power for essential work is being obtained. Markets for English coal are being lost in various European countries, though whether permanently or only temporarily is not yet clear. The import of coal has led in one or two districts to a decline in the shipping tonnage laid up. Nevertheless, the total tonnage of idle ships in the principal ports rose during the past three months. The American newspapers no doubt have recorded the various attempts to end the dispute. With both sides holding obstinately to their views, the problem has been that of the irresistible force meeting the immovable object.

Facts Not Available

The air has been full of statements regarding wages received, profits made, etc., each statement contradicting that which immediately preceded it, and the lack of authoritative information in Great Britain on industrial affairs generally has been contrasted with the statistical information published in the United States by the Department of Commerce, the trade associations, the Federal Reserve Board, and several more or less private agencies.

Indeed, a committee, self-appointed it would seem, has drawn up a report in which various American authorities are thanked for information received. C. E. Lyon, the American trade commissioner in London was specially mentioned. For various reasons, including the late war, British efforts in connection with a periodical census of production have not been of much service, and it would sometimes seem that the official statistics as to trade in Great Britain, admirable when first instituted, need revision in view of current conditions.

The proposal is that for each industry details should be obtained of total production, in quantities and selling values; cost of material; cost of labor, both direct and indirect; the charges that have to be met, such as rent, rates, insurance, depreciation, fixed salaries, etc.; balance available; and the number of wage-earners, with an indication of their ages and the wage rates. In many of these matters secrecy is the rule, and a number of balance sheets issued by public companies, etc., are best remembered for their lack of definite information. As a result, it would not be surprising if incorrect views are prevalent as to profits and similar matters.

The engineering trade as a whole has been maintained remarkably well during the critical period. Nevertheless, shops have had to close down and the iron and steel industries have naturally suffered directly from want of fuel. Many blast furnaces are inactive, and some foundries have had to use inferior material in order to continue.

Under the circumstances it is probable that the home trade in engineering has declined more than overseas trade. This is true of a number of machine tool firms, who have received quite a fair number of export orders, largely from countries having a sentimental or other preference for British products.

The position of the exchange in several European countries naturally does not encourage the importer there. The Glasgow correspondent of the European edition of this journal, who recently made definite inquiries on the point, reported that in general the Scottish toolmakers were then employed to about 50 per cent of their capacity. Firms were in receipt of export orders in the proportion of 50, 75 and 80 per cent of the total, while one firm, employed mainly on work for the home market, was definitely reported as experiencing unusual conditions.

The New Zealand government recently announced the acceptance of tenders for machine tools for railway workshops in that dominion, and these orders have been fairly well spread over the British machine tool area. Tenders are also to be invited for car and wagon shops and for the re-modelling of other workshops in New Zealand.

The machine tool firm that has not been definitely affected by the coal trouble is very difficult to find. Nevertheless, in common with other engineers, most such firms express the view that, the dispute being ended, a real revival in trade may be confidently anticipated.

The character of tools in demand has not greatly altered. The railway companies are still customers of the machine tool firms, and automobile and electrical engineers, have also placed orders. Taking motor cars as a whole, however, the trade this year has not fulfilled every anticipation. At the beginning of the season the weather acted as a handicap, while industrial troubles had their effect later. It is true that the use of commercial vehicles has advanced so rapidly as to cause some concern to the railways.

The railways service was increased when it was clear that sufficient imported coal could be obtained. Conversion for oil-burning has also been effected on locomotives.

W. & T. Avery, Ltd., which occupies the premises near Birmingham in which Watt and Boulton worked, recently built what is said to be the largest universal testing machine in existence; it is to be used by Dorman, Long & Co., Ltd., for testing parts of a bridge to connect the two sides of Sydney harbor, Australia. Alfred Herbert, Ltd., Coventry, is expected to close its works at the Butts in order to concentrate at Edgwick, on the outskirts of the town, where for a number of years the company has maintained a foundry and other sections specializing in milling machine production. A department for gear-cutting for the trade has recently been added.

New Machinery Trust Formed in Germany

The transfer of the machinery plants of the United Steel Works, in Germany and the withdrawal of the United Steel from machinery production in Germany has resulted in the formation of a new machinery trust, the organization of which is expected to be completed in the near future, according to the Department of Commerce.

The new company will be based on the Demag A. G., one of the largest machinery producers in Germany. The plant equipment of the Demag A. G., is valued at 18,600,000 marks and the annual production during the past year was estimated at 45,000,000 marks.

Included in the new organization will be the former plants of the "Demag," the Benrath, Duisburg and Wetter works, together with the total equipment of the Thyssen Machinery Co., under single management. The former participations of the "Demag" in the Schiess de Fries of Duesseldorf, the Tigler A. G. of Duisburg, Meiderich and Flohr of Berlin, will not be included in the new company.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

PRECEDENT says that a severe reaction in the New York stock market is overdue, but all signs fail in dry weather. Therefore the present boom may be an exception to the many similar movements that have preceded it. It is in fact a notable exception in one respect, for it has had the open support of a partner in the world's greatest banking house.

Just as he was sailing for Europe on the evening of July 31, this gentleman is said to have done the unusual thing by allowing himself to be interviewed. By wireless he has since announced that he did not speak for publication, but this will not impair the force of a statement in which the country's prosperity was acclaimed and an advance to 300 for General Motors Stock was suggested. The effect was electric. The trading on the New York Stock Exchange during the week has averaged well over 2,500,000 shares daily, and several issues have sold at the highest prices on record.

Of course there is no denying the increased wealth and the marvelous economic progress of the United States, but they can be discounted too rapidly and it may be that speculators are over-reaching themselves.

This seems to be the view of those who trade in bonds. They have withdrawn from the market, and appear to be awaiting further developments. Money is a shade firmer, but there is no scarcity of loanable funds, and the slight advance asked is predicated more upon the expectation of an advance in the Federal Reserve rate than upon any anticipation of an actual stringency. But an advance in the Federal Reserve rate if ordered would act as a brake upon speculation, and for this reason it is a possibility that should not be disregarded. General trade is if anything better, but the pæans of prosperity that are being chanted by the politicians do not appear to be entirely justified. Bank clearings for instance do not show the constant increase over last year hitherto reported, and although it is explained that some items previously included are now omitted, it is reasonably plain that the total turnover is not showing the phenomenal gain that was the rule until recently.

The dry goods trade is described as up to normal, whatever that may mean, but cotton fabrics are perhaps a shade easier in sympathy with cotton futures, which are lower upon better reports from the cotton fields. Incidentally, spinners' takings of American cotton for the season ending July 31 were the largest on record. In the shoe industry a distinct improvement is reported.

Silk and rayon are said to be between seasons in so far as wholesale distribution is concerned. The same statement applies to woolen goods and the men's clothing trade. Opinions differ, but most dealers claim that the lumber trade is better in the East as well as in the Pacific Northwest. Rubber is distinctly lower because the bears succeeded in averting a restriction of the exports from the rubber growing regions of the British Empire.

What's Doing in Industry

With the first half of August about gone, the volume of machinery and machine tool sales has slacked off a little. Inquiries, however, are plentiful, and many orders need only the confirmation of executives who are at present away on vacation. It is expected that much of the pending business will be closed before the end of the month.

The Mid-West is more active now than any section of the country. Automobile manufacturers continue to supply new business in the Detroit territory, and in Indianapolis a fair amount of sales has been registered from this same source. Chicago reports sales satisfactory, gears and gear-cutting machinery being in particular demand. The trend is upward in Cincinnati, general machine trades and industrials buying in fair quantities.

Inquiries have increased in the New England market, many shops planning additional operations in the fall. The New York market is a little quiet, but business is better than at the same time last year.

Canada reports a sufficiency of small orders, steel interests and railroads keeping up a good volume. The South shows a steady gain in sales, textile and small shop business making a satisfactory showing.

Viewed in its entirety the world seems happier and more prosperous than it has been for some time and the only thing that we have to fear is that we will let our elation warp our judgment.

But a further decline of importance seems unlikely, as the Stevenson plan will automatically reduce the marketable supply for the quarter beginning Nov. 1, unless the London price in the interval averages above 21 pence.

Sugar is distinctly firmer, especially for the near positions, and the statistical strength of the prospective situation is gradually asserting itself.

In Cuba there appears to be an organized effort to get President Machado to issue a decree limiting next year's production to 4,000,000 or 4,250,000 tons. If such a decree should be issued, a sharp advance would almost certainly follow.

Meantime the American demand for refined sugar is well sustained, and it has been augmented by the assurance of abundant fruit crops. The latest reports of the Department of Agriculture show increases over last year.

There has been more activity in wheat and corn. Economists think they are selling at about intrinsic value, but the farmers and some speculators are of a different opinion.

Prices are however without definite trend. Copper has been gently lifted to 14¼ by those who are gradually gaining control of the world's production, and the steel industry is cheerful on a normal summer business at steady prices. With the approach of autumn there are definite signs of a recession in the building industry, and although landlords may not admit it there is no doubt that rents are being shaded in the larger cities.

Europe is more complacent. The British seem to think the end of the coal strike is approaching and the political support given Poincare's proposals has advanced the franc to nearly three cents. Its ultimate value depends upon the willingness of the French people to pay the taxes that the present ministry is getting ready to impose.

There is reason to hope that the conflict between the Catholic Church and the Mexican government may be composed, and a sharp decline in the price of silver caused by the prospective adoption of the gold standard in East India is about the only item in the foreign news that is economically disturbing.

Viewed in its entirety the world seems happier and more prosperous than it has been for some time, and in America the only thing that we have to fear is that we will let our elation warp our judgment. This is a real danger in times like the present, and those who are wise will guard against it.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

The month of July closed with a satisfactory volume of business booked by manufacturers of and dealers in machine tools. Sales in most instances were reported to be in excess of those recorded in June, and in most cases were materially ahead of July 1925. August, thus far, shows no indication of a seasonal slump, dealers for the most part stating that, while trade is not especially active, there is sufficient being done to keep their sales departments fairly busy.

Manufacturers of gears and gear cutting machinery report a good business for the last several months, and express the belief that this condition will continue. Local representatives of standard tool manufacturers are booking some good orders received from their salesmen covering the Middle-Western states, general industry contributing the greater share. Railroad buying is practically limited to three or four of the Western trunk lines, the C. & N. W. R.R. leading with its new list of 29 tools, mostly of standard make. A few orders for equipment are still being received from the International Harvester Co. for its Rock Island tractor plant.

Detroit

Little change has taken place during the past week in the machinery and machine tool field in Detroit and other automobile centers in southeastern Michigan. Sales remain somewhat spotty, with demand for equipment rather widespread but in small quantities.

The one notable exception to this prevailing condition is the Cadillac Motor Car Co. which has placed orders for several hundred thousand dollars worth of new machinery, all of a heavy type, with which the company will start the manufacture of a straight-eight within the next few months.

The larger machines, all of which must be specially built, are being ordered, while the smaller tools are being left until later. Blueprints call for the construction of several different types of machines, from drills, boring machines and lapping machines to milling machines and presses.

The new body plant of the Hudson Motor Car Co. in which the new all-steel bodies of the Essex will be constructed has been finished and production had been started. Essex bodies were formerly built by Briggs.

Railroads are buying in larger quantities than for some time. This is especially true of the Pere Marquette which has just placed orders for new machinery for both the Saginaw and the St. Thomas, Ontario, shops.

Employment has gained in the past few weeks, showing a healthy condition of Detroit manufacturing establishments that portends better sales of machinery during the last quarter of the year.

Cincinnati

The trend of the Cincinnati machine tool market, taking it as a whole, has been slightly upward in the past week. The majority of manufacturers and selling agents report some increase in demand, and none report a falling off. The tone is better than it was at this time last year, and it is predicted that a busy period for the whole industry is near at hand.

Orders booked in the week came from various classes of machine tool users, located in all sections of the country, and the tools purchased were well diversified as to sizes and types. Most of the tools bought were for replacement purposes but in a few cases they were added for business extension.

The feature of the week's buying was the purchases by general machinists and industrial machine tool users. Railroads placed a few scattering orders for single tools and sent in a fair number of lists of requirements. Concerns in the automotive industries confined their purchases to single tools, but an encouraging number of inquiries were received from this source.

There is a feeling of optimism among manufacturers and selling agents which did not exist at this time last year, and there is not as much let down of selling effort now as there was then.

Based on the belief that machine tool users have postponed their buying to the ultimate limit, it is predicted that a livelier market is developing.

Canada

While orders for machinery and machine tools in Canada are not large, buying is becoming more general, and it is fully expected that the second half of the year will show a marked improvement over the corresponding period of last year.

The steel business is being maintained at a remarkably high level for this time of the year. At the end of July most of the large plants, both producers and consumers, reported business received in excess of that at the same period last year. The Algoma Steel Corporation has secured a 6,000-ton order of standard section rails from the Wabash R.R. This company announces plans for the erection of a new screening plant, at a cost of $250,000, it having been decided to permanently enter the domestic coke market. The Verity Plow Co., and Waterous Ltd., Brantford, Ohtario, report satisfactory operations; while the vice-president of the International Harvester Co. states that the Hamilton plant has never been so busy as at present. Reports from British Columbia are to the effect that iron and steel plants there are well booked.

The Canadian railroads, showing an amazing recovery during the last few months from a period of lean revenues, are now coming into the market for equipment which is long overdue. Automobile production for the first six months of the year shows an increase of 33 per cent above the number made for the same period in 1925.

New England

Production in the New England machine building plants is being hampered to a noticeable degree this summer by the extreme heat. This has caused frequent shut-downs in foundries and has slowed down the work in machine shops.

There is a better inquiry from prospective buyers of machine equipment and the tenor of the letters is indicative of expansion plans. The inquiries come from the country in general, with a suggestion of good prospects in the automotive field. Farm machinery builders are also well represented in the prospective market field. Buying by radio parts manufacturers is slowing down.

Immediate bookings are for the most part for the automotive trade and deliveries are in the majority for this particular branch of industry.

The second-hand machinery stock in this section is pretty well depleted and is inadequate to meet demands, according to some of the dealers. This is especially true of high-class tools of a more modern character.

Indianapolis

Sales of machinery and machine tools are holding their own, compared with the month of July. Little change is to be seen in the general situation. Some spottiness still is reported and is rather expected at this season of the year. With the rapid growth of the bus business in this state, dealers in small shop tools are finding an unexpected market. Most of the bus companies are equipping complete garages and will make all ordinary repairs with their own force of mechanics.

Automobile demand is not so good. The local factories have not begun fall production. However, some volume is reported from the accessory factories. The Hassler plant, Marmon, Stutz, Studebaker, and Chrysler at Newcastle, report prospects bright for fall.

Railroad buying continues dull. Repair programs are being cut and little business is expected from this source before late fall. The volume of inquiries for special machinery from the coal fields is increasing. The same is true of the brick manufacturing section in the Western part of the state.

Sales to the lumber manufacturing mills in the South and on the West coast are reported fair in volume. The business is hardly what it was this time last year, but a good fall is expected. Some demand is reported during the last two weeks for special machinery for furniture factories. Several Indiana factories are increasing their production and plan replacements.

Southern District

Machinery and tool sales in the Southeast continued to show steady strides in the last two weeks, with a certainty that August business will exceed the corresponding period last year. Distributors are very optimistic over the outlook, and believe they will continue to enjoy good call, as the present inquiries are on a much better than normal basis for this time.

Textiles, lumber and woodworking, and garage equipment are among the lines showing the best advances lately. Textile business is opening up again after a few weeks of dullness, and though sales as yet have not reached healthy proportions the inquiries are excellent. Dealers look for a better than normal call from the textile industry during August, and believe sales will hold up well into the fall.

Decided improvement is also noted in woodworking machinery sales, Atlanta distributors report many sales to furniture factories, planing mills and sawmills in the last two or three weeks. Garage equipment is the most active it has been in three or four years, and there is an especially healthy demand for new machinery, whereas the call is usually best for used and rebuilt equipment in this field. The first seven months of the year probably established a record with this line in the Southeast, in spite of two months of dullness earlier in the season.

Railroads are not very active right now, though business is about normal and inquiry promises it will continue so. Roadbuilding and contractors' machinery continue fairly good for this season.

New York

The first ten days of August has brought a slight slackening of activity in the machinery trade in this market. July proved to be an exceptionally good month, and present inquiry would seem to promise as good for August. But the height of the vacation season has tended to put off the placing of many orders that need only executive sanction. This requirement will come eventually, but in the meantime orders are held up.

There has been an improvement in the demand for machinery used in the fabrication of steel and other metals for the construction industries. Sales are reported good for presses, dies, bending and cutting machinery and welding equipment.

Railroads continue to place orders, although the large orders that were expected are still in that state. The Texas Pacific, the C. C. & St. L., the Pere Marquette, the New Haven and the Missouri Pacific are mentioned among the important buyers. Heavy duty boring mills, steam hammers, engine lathes and bushing presses are inclosed in the new orders. Other equipment closed includes: Six lathes, 5 Lincoln type millers, 3 die sinkers, 3 vertical shapers, 2 thread millers, one jig boring machine and 2 turret lathes.

The second-hand market has shown slight improvement with the recent liquidation of one or two large plants in this territory. Good tools are again available and buyers are keen to take advantage of prices.

S.A.E. Recommends Including Rockwell Hardness Tests in Present Practice

Specifications now cover Brinell and Shore methods

At the recent meeting of the iron and steel division of the Society of Automotive Engineers, the desirability of including the Rockwell hardness-test in the present "S.A.E. Recommended Practice for Hardness Tests," which includes the Brinell and Shore methods of testing, was recognized by the approval of a report submitted by the subdivision on hardness tests, consisting of J. H. Nelson, of the Wyman-Gordon Co., chairman; L. A. Danse, of the Cadillac Motor Car Co.; H. L. Greene, of the Willys-Overland Co., and S. P. Rockwell, of the Stanley P. Rockwell Co.

The test recommended by the subdivision follows:

Principle of Test.—The Rockwell tester measures hardness by determining the depth of penetration of a steel ball or diamond cone in the material being tested under certain conditions of load application. In elevating the work to testing position, the machine first applies a preliminary, or minor, load of 10 kg. (22.046 lb.), which clamps and seats the piece being tested and allows the penetrator to break through the light scale and come in contact with the true material beneath. The direct-reading dial is set to zero penetration, directly after due application of the minor load. With the minor load applied and a zero penetration reading known, a final or major load is applied. This forces the penetrator into the metal being tested. The indication at this time on the direct-reading dial comprises not alone the depth of penetration but also the deformation of the testing-machine frame and components, and the work undergoing test. The true Rockwell hardness is read directly from the dial, after removing the major load. This automatically reinstates the 10-kg (22.046-lb.) minor load and removes the deformation of the machine and part under test. The result is the permanent deformation of the tested metal due to the penetrator and its major load. The Rockwell hardness-readings are based on the depth to which the major load forces the penetrator below the point it was forced previously by the minor load.

Preparation of Surfaces.—A surface similar to that obtained by rough-grinding with a sandstone, carefully cooling the pieces in water to prevent change in hardness due to the heat of grinding, is sufficient for research work. In production it is customary to remove the heavy scale only, as a polished surface is unnecessary.

Thickness of Specimens.—Practically any thickness in excess of 0.020 in. can be tested for comparative hardness. For true hardness, the piece must be of such thickness that the under surface of the specimen, after testing, does not show a point of compression. The minimum possible thickness of any specimen varies according to the hardness, the load applied and the kind of test-point or penetrator used. The hardest steels give true hardness-readings if over 0.027 in. in thickness.

Curved Surfaces.—The true hardness of parts having curved surfaces can be found if the radius of curvature of the surface at the point tested is $\frac{1}{8}$ in. If the radius is less than $\frac{1}{8}$ in., only comparative results can be obtained. Data for hardness-tests on a highly curved surface should be accompanied by a statement of the radius of curvature. In testing small rounds, the effect of curvature can be eliminated by making a small flat-spot on the specimen.

Rockwell Scales. — Since two loads and two penetrators are used, two scales of hardness are placed on the dial of the machine. The black divisions and the letter C apply when the 120-deg. diamond-cone penetrator and the 150-kg. (330.693-lb.) load are employed. The red divisions and the letter B apply when the 100-kg. (220.462-lb.) load and the $\frac{1}{16}$-in. steel-ball penetrator are employed. All data should be prefixed by a letter showing whether the values are on the C or the B scale. Other loads and penetrators can be used, but only comparative results can be obtained. In recording such results all factors relating to them should be clearly stated: the load; the penetrator; the scale used; the thickness of the piece, if very thin; and the curvature of the surface.

Penetrators and Loads.—The Rockwell scale being based on depth measurements, the diamond-cone gives the more accurate readings on hard metals and the steel-ball on soft metals. Hard metals require the 150-kg. (330.693-lb.) load; the diamond-cone penetrator of 120-deg. angle, the point of which is ground spherical by the maker, is the standard Rockwell diamond-cone.

If the readings are below C-25, it is preferable to test the material with the 100-kg. (220.462-lb.) load and the $\frac{1}{16}$-in. steel-ball, and use the B scale. Readings on the B scale are not generally taken higher than B-100, when it is advisable to change to the C scale with the 150-kg. (330.693-lb.) load and the diamond-cone test-point.

Each tester is provided with means for regulating the rate of application of the load, for which the standard speed is 5 sec. for production-testing on steel. A speed of 3 sec. can be used without appreciably affecting the readings. Metals that flow readily under pressure, like zinc, should be tested under a specified rate and the duration of the application of the load should also be specified.

Chucking the Work.—Parts with much overhang should be suitably supported so that, when the minor load is applied, the work will be held rigidly. The piece being tested, while under the pressure of only the minor load, must be secure so that it will not tend to tip at the edge of the anvil and move laterally under the major load.

The surface tested should not vary from the horizontal with reference to the vertical axis of the penetrator more than $7\frac{1}{2}$ deg. In testing cylindrical pieces, such as wire, an anvil provided with a V-notch should be used and the point of penetration applied vertically over the center of the piece. The under-surface of the piece, where it rests on the anvil, must be free from scale or burrs that might collapse or flatten during the test.

In testing tubing or any shape that will deform under test, a blunt nose should be used in place of the penetrator, and the test conducted in the regular way to determine if the specimen takes a permanent set, that would invalidate the hardness-test and necessitate consideration of another manner of chucking.

Homogeneity of Metals.—The Rockwell tester measures the hardness of the specimen at the point of penetration, but the reading is also influenced by the hardness of the material under the impression. For example, in testing the hardness of carbon steels, the depth of penetration, when using a diamond-cone and the 150-kg. (330.693-lb.) load, is about 0.027 in., but, if any softer layer is located within 0.027 in. of the impression, the impression will be deeper and the apparent hardness less. Therefore, due regard for this condition must be given when testing material with a superficial hardness, such as a cyanided surface.

Conversion to Other Methods of Hardness-Testing. — Care should be used in converting readings from one method of hardness-testing to another. The factors that cause erroneous conversions are:

Lack of true homogeneity in metals.

Different depths from the surface at which various hardness-tests operate.

Different physical characteristics of various testing devices.

Different properties that are assumed by different metals under cold-working.

No one conversion-table is practical for close conversion on all metals. Tables and formulas have been compiled for some materials that can be used as guides. When conversion is necessary, it is advisable to make such conversion for each particular type of metal and each condition of heat-treatment or mechanical work.

Industrial Machinery Exports Show Gain

Reports of the Department of Commerce show that the importations of machinery into Uruguay in 1925 considerably exceeded those of 1924. The total amounts are, respectively, $2,300,000 and $1,300,000. Of these totals, industrial machinery and accessories represented a value of more than $1,130,000 in 1925.

The total imports of industrial machinery into India, during the fiscal year ending March 31, 1925, amounted to $39,149,147, and represented a decline of $11,047,497 from the total for 1924. Exports from the United States to India amounted to $3,605,975, or about 9 per cent of the total industrial machinery trade.

News of the Automotive Industry

The value of all automotive products exported from the United States during the first six months of 1926 amounted to $182,066,573, an increase of 9.4 per cent over the exports during the corresponding period of the former peak year 1925, when they totaled $166,457,821, according to the automotive division of the Department of Commerce. Canadian automotive exports during the same period of this year amounted to $19,734,610, a gain of 12.6 per cent over the exports from that country during the first half of 1925 which were valued at $17,533,292.

A six-million-dollar automobile plant, one of the largest industrial building contracts in the country let this year, has been placed with the Austin Co., of Cleveland. The new Pontiac plant for the Oakland Motor Car Co. is to be built at Pontiac, Mich. Work was started Aug. 6. This construction contract followed close on the heels of an engineering contract.

A three-day auction of buildings, real estate and machinery of the Apperson Brothers Automobile Co., at Kokomo, Ind., ended recently, tools, machinery and office equipment selling in 1,400 separate lots, bringing a total of $80,000. No bids were received for the office building or any of the factory buildings. The real estate will be offered at a private sale.

Officers of the Kokomo Motor Car Co., a proposed corporation for the manufacture of a new type of automobile engine at Kokomo, have failed to obtain state approval to sell a $2,000,000 preferred stock issue. The new motor, invented by W. H. McIntyre, of Kalamazoo, Mich., is said to have advantages over the present type in that instead of the poppet valve, a piston valve is used.

Earnings of the General Motors for the first six months of 1926 offer opportunity for conjecture concerning prospects for the last half of the year, leading to the conclusion that at present the corporation is in as favorable a position to establish another earnings record during the current six months as it was at the beginning of the fiscal period ended June 30. Former sales and earnings records were so far outclassed during the past six months that they now serve their most useful purpose as a basis for projecting possible future results. The entire earnings of G. M. were $93,285,674 for the period.

Personals

THOMAS D. MCCLOSKEY has been elected chairman of the board of the Firth-Sterling Steel Co., of McKeesport, Pa.

O. V. PARSONS has been appointed assistant to the chief engineer of the Norfolk & Western Ry. Co., at Roanoke, Va.

G. K. HOWARD has been appointed vice-president and regional director of the Far East Dept., of the General Motors Export Co.

J. H. HEDGES, consulting mining and metallurgical engineer, has been added to the administrative staff of the Bureau of Mines.

LOUIS D. MOORE, with offices at 1201 Syndicate Trust Bldg., St. Louis, has been appointed district sales representative for the Burke Electric Co., of Erie, Pa.

RALPH SIMPSON has been appointed sales manager of the Leon J. Barrett Co., of Worcester, Mass. He was formerly associated with the Potter & Johnson Machine Co.

SAMUEL ARNOLD, 3rd, has been appointed representative in the Pittsburgh district for the Pennsylvania Pump and Compressor Co., of Easton, Pa. He has established offices in the Fulton Bldg., in that city.

V. V. CASEY has joined the sales force of the Bonney Forge and Tool Works, of Allentown, Pa., and will travel in Pennsylvania, southern New York, Maryland, District of Columbia and New Jersey.

HARRIS E. DEXTER, of New York, has been appointed chief of the electrical equipment division of the Department of Commerce. He succeeds R. A. Lundquist, who resigned recently to enter private business. Mr. Dexter has had engineering and sales experience with the General Electric Co., and the Boston Edison Co. More recently, he has been manager of the commercial division of the Servel Corporation.

PRESTON B. POSTLETHWAITE has been elected president of the Wagner Electric Corporation, of St. Louis, Mo., succeeding Waldo A. Layman, who resigned several weeks ago. Mr. Postlethwaite has been associated with this company since 1909 and has held various positions of a high executive character. He organized the service department of the company and was assistant to the president of the company during the period of the recent war. He has been a vice-president and director for two years.

Obituaries

JOHN D. SELLS, widely known in transmission machinery circles, and former sales manager of the Royersford Foundry and Machine Co., of Philadelphia, Pa., died on July 29 at Atlantic City, N. J. He was 69 years old. Mr. Sells, after giving up law because he liked business better, became associated with the Charles Bond Co., Philadelphia, and afterwards became sales manager for the Royersford company. He retired from the position of director of sales four years ago. Since then, he spent most of his time in traveling around the country, looking after various personal interests.

Business Items

The W. C. Fletcher Co., of 725 Continental Bank Bldg., Indianapolis, has been appointed district sales representative in that territory for the Burke Electric Co., of Erie, Pa.

The Rawplug Co., Inc., of 66 West Broadway, New York City, has been appointed exclusive sales agent in the United States for Simbi hammers, manufactured by the Fermot Co., of New York.

The General Electric Co. announces the payment of $1,396,002 in supplementary compensation to over thirty-thousand employees of its various plants and offices who have been employed by the company for five years or more. The sum represents 5 per cent of the earnings of these employees for the six months ending on June 30.

The Oakley Chemical Co., of New York, announces a change in the firm name to Oakite Products, Inc. No change is made in the management or personnel of the company, but a program of industrial expansion is under way. The general offices of the company will continue at 22 Thames St., New York City.

T. I. DRIGGS, vice-president and general manager of the American Pin Co., division of the Scovill Manufacturing Co., Waterbury, Conn., has resigned. Mark L. Sperry, Jr., has been named production superintendent, and George A. Goss general superintendent of the division. The position of general manager and vice-president will not be filled at present.

The New Departure Manufacturing Co. is occupying its new forge shop that is said to be one of the most completely equipped plants in the country. High-carbon electric furnaces have been installed. An addition, 250 x 75 ft., has been built for the machine shop and this makes the plant machine shop one of the largest building of the New Departure group. The addition to the forge shop makes this structure 600 x 126 ft. Sixty-five forging machines comprise the equipment, making the capacity for bearings about 150,000 a day. The new rolling mill is 150 x 75 ft. and is furnished with modern equipment.

The National Acme Co., of Cleveland, Ohio, announces that in the future all Model B and Model C Acme machines will be built at and shipped from its plant at Windsor, Vt. This change was occasioned by the more ample manufacturing facilities in the New England plant. All Model A machines will for the time being continue to be built at Cleveland. The general sales offices will remain there. A supply of tools and repair parts for all types of machines will be carried in stock in Cleveland for prompt shipments. The plant of this company at East 131st St. and Coit Road, Cleveland, will continue to make screw machine products, standard screws and nuts, and automatic threading tools.

The Black & Decker Manufacturing Co., of Towson, Md., has just completed the erection of a new Pacific Coast home at 6th Ave. and 10th St., Oakland, Cal., which it will occupy on Sept. 1. This building will be used as a branch office, service station and distribution warehouse. The old quarters at 75 Fremont St., San Francisco, have become too small to take care of constant expansion. The purchase of the site and the erection of the building has been under the supervision of M. A. Johnson who has, for the past several years, been in charge of Black & Decker Pacific Coast business. Distribution to the entire West Coast of the Black & Decker line of portable electric drills and heavy-duty grinders and buffers will be made from this branch where larger storage space and service facilities will make possible immediate deliveries.

Forthcoming Meetings

Industrial Conference. Ninth annual industrial conference on human relations, under auspices of Young Men's Christian Associations, Silver Bay, Lake George, Aug. 26 to 29.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 7 to 10. William Hall, secretary, 1061 West Wabash Ave., Winona, Minn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

American Gear Manufacturers Association. Semi-annual meeting, Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 14, 15 and 16. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

FEW price changes occurred in steel products during the week. Scrap is measurably higher. Demand appears more active for semi-finished material, shapes, rails, nails, wire and pipe. Black steel sheets rose 10c. and blue annealed declined 5c. per 100 lb. at Pittsburgh mills, comparing this week with last. Upward price movement in nonferrous metals is reflected in higher quotations for fabricated brass and copper, solder, babbitt metal, etc. Market for wiping material is soft. Linseed oil rose ½c. Aug. 5, to 95½c. per 7½ lb.-gal., f.o.b. New York.

(*All prices as of Aug. 6*)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.15	3.50
No. 12	2.30@2.35	3.94	3.20	3.55
No. 14	2.35@2.40	3.99	3.25	3.60
No 16	2.45@2.50	4.09	3.35	3.70
Black				
Nos. 18 to 20	2.90@2.95	4.30	3.65	3.90
Nos. 22 to 24	2.95@3.00	4.35	3.70	3.95
Nos. 26 and 27	3.00@3.05	4.40	3.75	4.00
No. 28	3.10@3.15	4.50	3.85	4.10
Galvanized				
No. 10	3.20@3.30	4.65	4.00	4.25
Nos. 12 to 14	3.30@3.40	4.75	4.10	4.35
No. 16	3.45@3.55	4.90	4.25	4.50
Nos. 18 to 20	3.60@3.70	5.05	4.40	4.65
Nos. 22 to 24	3.75@3.85	5.20	4.55	4.80
Nos. 26 and 27	3.90@4.00	5.35	4.70	4.95
No. 28	4.20@4.30	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ⅛	¼	⅜	½	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼, 7.85c.; ⅛" to ⅜", 7.35c. per lb. *Flat, ⅛"@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.75
Tin, 5-ton lots, New York			66.87½
Lead (up to carlots) E. St. Louis	8.85	New York	9.50
Zinc (up to carlots) E. St. Louis	7.40	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	17.00	20.50	17.00
Copper sheets, base	22.75	23.00	22.75
Copper wire, base	19.75	20.00	16.25
Copper bars, base	22.37½	22.62½	22.12½
Copper tubing, base	24.75	25.00	24.75
Brass sheets, base	19.12½	19.37½	19.12½
Brass tubing, base	24.00	24.25	24.75
Brass rods, base	16.87½	17.12½	16.87½
Brass wire, base	19.62½	19.62½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	28.00	27.00	27.02
Zinc sheets (casks)	13.25	12.55	11.76
Solder (½ and ½), (case lots)	41.00	40.00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	80.00
Commercial genuine, intermediate grade	55.00
Anti-friction metal, general service	30.50
No. 4 babbitt (f.o.b.)	14.75

Nickel, f.o.b. refinery, cents per lb.: Ingots..... 31.00 Electrolytic.. 38.00 Shot.....32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00 @12.25	11.25	11.50@12.00
Copper, heavy, and wire	11.50 @11.75	11.50	11.00@11.50
Copper, light, and bottoms	9.75 @10.25	9.75	10.00@10.50
Heavy lead	7.00 @ 7.50	6.75	7.25@ 7.75
Tea lead	6.00 @ 6.25	4.75	6.00@ 6.50
Brass, heavy, yellow	7.00 @ 7.50	7.25	7.50@ 8.00
Brass, heavy, red	9.75 @10.00	9.50	9.00@ 9.50
Brass, light	6.00 @ 6.25	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.25 @ 8.75	8.00	7.75@ 8.25
Zinc	4.50 @ 4.75	4.50	4.50@ 5.00

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade: IC,	14x20	$12.10	$11.95	$11.50
"A" Grade: IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	3.60†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.95½	1.05	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. kegs. †Per 150 lb. lot. ‡Per 425 lb. barrels

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1687½	.1662½	.1637½
Solder (½ and ½)	per lb.	.405	.3912½	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.75@ 3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@ 4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅜-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ala., Montgomery — Teague Hardware Co., 132 Commerce St.—two power pipe threaders, for 2- to 6-in. and 1- to 2-in. pipe.

Ga., Atlanta — Pullman Co., Pullman Bldg., Chicago, Ill. — equipment for new $1,000,000 plant, here.

Ky., Lexington—City Hall Garage, 106 Barr St.—lathe and grinding wheels.

Mass., Boston—City, School House Dept., City Hall—millwright equipment for machine and woodworking shops in East Boston High School.

Mass., Boston—Jones Bros. Co., 10 High St.—back geared granite cutting lathe to swing 5-0 diameter, 25-0 long.

Mich., Detroit — Electric Refrigeration Corp., 2448 Buhl Bldg.—machinery and equipment for the manufacture of electric refrigerators.

Mo., St. Louis—Mound City Fdry., 4501 North Euclid St.—one or more No. 3 modern Arcade moulding machines.

O., Columbus — Bd. Educ., 270 East State St., H. P. Smith, school engr.—5 lathes, 4 drill presses, 2 universal chucks, 2 floor type grinders, 2 Blout grinders, two 14 in. shapers, two 30 in. planers, three 30 in. joiners, 2 band saws, etc., for manual training department.

O., New London—H. S. Haynes, North Main St., H. S. Haynes, owner—equipment for garage and repair shop.

O., Wellington — F. B. Rockcliffe Mfg. Co., North Main St., F. B. Rockcliffe, Pres. —metal working machinery for manufacturing rope hoists and metal stampers, etc.

Pa., Warren—G. G. G. Metal Stamping Co.—back geared press equal to Bliss 21-S.

Que., Montreal—Catholic School Comrs., 44 Wickstaad St.—complete manual training equipment.

Opportunities for Future Business

Calif., Bishop — State Highway Comn., Sacramento, awarded contract for the construction of a maintenance shop, etc., here. Estimated cost $14,687. Noted July 8.

Calif., Los Angeles—Central Auto Club, c/o C. S. Cobb, Archt., Bank of Italy Bldg., is having plans prepared for the construction of 10 story, 160 x 180 ft. clubhouse and garage, at 8th St. and Grand Ave. Estimated cost $650,000.

Calif., Maywood—Union Iron Wks., 5125 Santa Fe Ave., Los Angeles, will build 153 x 450 ft. iron plant, shops, etc., with electric craneways, here.

Conn., Winsted—Stand & Sweet Mfg. Co., Meadow St., is having plans prepared for the construction of 2 story, 50 x 80 ft. wire factory, here. Estimated cost $40,000. Mylchrest & Reynolds, 238 Palm St., Hartford, Archts.

Ga., Atlanta — Pullman Co., Pullman Bldg., Chicago, Ill., plans the construction of addition to newly acquired plant, here. Estimated cost $1,000,000.

Ind., Fort Wayne—J. C. Kreidt & Co., 517-19 Ewing St., is receiving bids for the construction of 1 story, 60 x 142 ft. addition to tin shop, here. Estimated cost $30,000. H. W. Meyer, Ft. Wayne, Archt.

Ind., Ft. Wayne—L. J. McCullough has had plans prepared for the construction of repair shop and garage, here. Estimated cost $25,000. H. Schnow, Ft. Wayne, Engr.

Ind., Indianapolis—School of Blind, State House, awarded contract for the construction of garage, power house, etc., at 75th St. and College Ave. Estimated cost $104,226.

Mass., Amherst—M. S. Paige, Amity St., awarded contract for the construction of 60 x 100 ft. repair and service garage. Estimated cost $40,000. Noted Aug. 5.

Mass., Boston—E. I. Brown, 18 Tremont St., is receiving bids for the construction of 80 x 200 ft. repair and service garage on Rhodes St. To exceed $40,000. S. E. Moffie, 51 Cornhill, Archt.

Mass., Brighton (Boston P. O.) — A. Geiger, Jr., 79 Milk St., Boston, awarded contract for the construction of 100 x 125 ft. repair and service garage at North Beacon and Hickborn Sts., here. Estimated cost $100,000.

Your machine-tool wants inserted here free of charge

Address
BUSINESS NEWS DEPARTMENT
McGRAW-HILL CO., INC.,
10th Ave. at 36th St., New York.

Mass., Cambridge — Lever Bros. Co., Broadway, awarded contract for the construction of 2 story, 45 x 80 ft., kettle building extension, here. Estimated cost $50,000.

Mass., Cambridge (br. Boston)—Lesser & Levine, c/o Miller & Levi, Archts., 46 Cornhill, Boston, will build 1 story garage on Main St. between Albany and Portland Sts. Estimated cost $200,000. Work will be done by separate contracts. Noted Aug. 5.

Mass., Springfield—Chapman Valve Mfg. Co., Pine St., awarded contract for the construction of 2 story, 60 x 100 ft. maintenance building, at plant, here. Estimated cost $100,000.

Mich., Detroit — Electric Refrigeration Corp., 2448 Buhl Bldg., is having plans prepared for the construction of plant for the manufacture of electric refrigerators, office, etc., on Plymouth Rd. Estimated cost $3,000,000. Private plans.

Mo., Poplar Bluff—Missouri Pacific R.R. Co., 208 South La Salle St., Chicago, Ill., is having plans prepared for the construction of modern repair shops, etc., here. Estimated cost $300,000. E. A. Hadley, Ch. Engr.

N. J., Trenton—C. V. Hill & Co., 360 Pennington St., awarded contract for the construction of 2 story addition to refregerator factory, at plant, here. Estimated cost $50,000.

O., Cleveland—J. Bassichis & Son, Society for Savings Bldg., had plans prepared for the construction of 2 story, 66 x 116 ft. garage on Hamilton and Ontario Sts. Estimated cost $100,000. L. C. Lamb, 2159 West 89th St., Archt.

O., Cleveland — Cleveland Railway Co., Hanna Bldg., J. H. Alexander, Vice-Pres., is having plans prepared for the construction of 100 x 175 ft. car service building, etc., at West 117th St. and Lorain Ave. Estimated cost $200,000. D. W. Morrow, 4500 Euclid Ave., Engr. and Archt.

O., Cleveland — Cleveland Switchboard Co., 2925 East 79th St., F. C. Hafemeister, Pres., is having plans prepared for the construction of a 1 story, 30 x 140 ft. addition to factory, at 2925 East 79th St. Estimated cost $40,000. Private plans.

O., Cleveland — J. W. Ladd Co., 758 Woodland Ave., awarded contract for the construction of a 2 story, 60 x 165 ft. garage and plant for the manufacture of dairy equipment. Estimated cost $100,000.

O., Cleveland—Willard Storage Battery Co., 246 East 131st St., R. C. Noberg, Vice-Pres. and Genl. Mgr., had plans prepared for the construction of a factory, at Taft Ave. and 131st St. Estimated cost $250,000.

O., Fostoria—National Carbon Co., West 117th St. and Madison Ave., M. W. Allen, Mgr., is having plans prepared for group of twelve 1 to 5 story buildings, at plant, here. Estimated cost $1,500,000. Stone & Webster, 24 Federal St., Boston, Mass., Engrs. and Archts.

Pa., Philadelphia—Logan Oakland Motor Co., 4718 North Broad St. is having plans prepared for the construction of a 3 story, 60 x 138 ft. service and sales building, at 4718 North Broad St. Thalheimer & Weiss, Wesley Bldg., Archts.

O., Milford—Miami Chevrolet Co., E. C. Shumard, pres., had plans prepared for the construction of 1 story, 50 x 60 ft. garage, on Main St. Estimated cost $35,000.

O., Steubenville—Wheeling Steel Corp., Manchester St., Wheeling, W. Va., G. H. Hocking, Secy., awarded contract for the construction of 1 story, 700 ton capacity blast furnace, here.

Tenn., Memphis — Memphis National Garages, Inc., plans the construction of 9 story garage on North Front and Court Sts. Estimated $1,000,000 . Marr & Holman, Stahlman Bldg., Nashville, Archts.

R. I., Providence—L. S. Brice, 112 11th St., awarded contract for the construction of a 1 story, 60 x 215 ft. garage, at Hope St. and Hillside Ave. Estimated cost $75,000.

R. I., Providence — New York, New Haven & Hartford R.R. Co., awarded contract for the construction of 1 story garage and repair shop, on Kingsley Ave. Estimated cost $40,000. Noted June 3.

Wis., Janesville—Fisher Body Co., General Motors Bldg., Detroit, Mich., awarded contract for the construction of 1 story, 150 x 645 ft. plant, here. Estimated cost $200,000. Noted July 29.

Wis., Madison—Behrend Bors., 203 East Washington Ave., awarded contract for the construction of a 1 story, 66 x 96 ft. service station, and shop. Estimated cost $40,000.

Wis., Milwaukee—Frank D. Chase, Inc., 720 North La Salle St., Chicago, Ill., Engr. and Archt., will soon receive bids for the construction of a 1 story, 120 x 308 ft. addition to foundry and machine shop, at 39th and Orchard Sts., for Chain Belt Co., C. R. Messinger, Pres.

Wis., Milwaukee—Engel Tool & Forge Co., 338 Davidson St., is receiving bids for the construction of 1 story, 40 x 50 ft., factory, Orchard St. Estimated cost $10,000. Private plans.

Wis., New Diggins—Mineral Point Zinc Co., Mineral Point, W. R. Smith, Genl. Supt., will build wet zinc mill here. Estimated cost $40,000. Work will be done by day labor.

Ont., Belleville—National Castings, Ltd., N. Turner, mgr., plans the construction of 1 and 2 story foundry, to replace plant, recently destroyed by fire. Estimated cost $50,000. Architect and engineer not selected.

Ont., Ludbury—Gardners Garage, Lorne St., awarded contract for the construction of a 2 story garage, on Lorne St. Estimated cost $40,000.